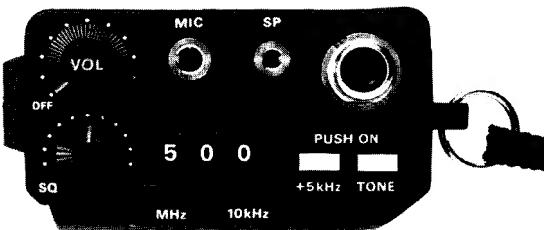
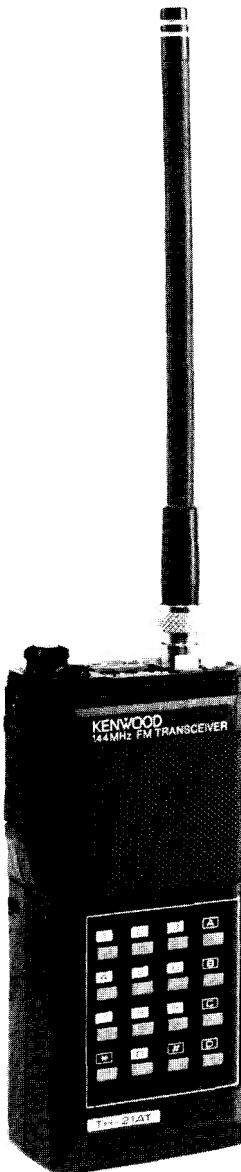


# KENWOOD

# SERVICE MANUAL

**TH-21A/AT/E** BT-2, DC-21, EB-2, PB-21,  
SC-8/8T, SMC-30, TU-6

## 2m FM HAND-HELD TRANSCEIVER



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Photograph shows TH-21AT type.

## CIRCUIT DESCRIPTION

Model	Destination	Frequency range (MHz)	RPT-SHIFT Freq' (kHz)	TONE	Ref'
TH-21A	K1,M1,M2	144.00-147.995	±600	Option (TU-8)	
	X	144.00-145.995			
TH-21AT	K2,M3,M4	144.00-147.995			DTMF System used
TH-21E	T	144.00-145.995	-600/REV	1750Hz	TRIO Brand
	W			TONE BURST	
				1750 Hz TONE	

K : U.S.A. M : Gen. T : England W : Europe X : Australia/Newzealand

**Table 1 Destination chart**

## RX Section

The TH-21A/AT/E uses a double super-heterodyne type receiver with a IF frequency of 16.3MHz and a second IF frequency of 455kHz.

The received signal from the antenna is amplified by RF amplifiers Q1 : 2SC2176(H) and Q2 : 2SC2668(Y), which are in connected cascade, and applied to BPF L6-L8. The RF signal is then applied to the first mixer, Q3 : 2SK192A, where it is mixed with the first local oscillator signal from the PLL. The first mixer output passes through a 16.3MHz MCF (F1) and becomes the first IF signal. This signal is amplified by IF amplifier Q4 : 2SC2714(Y) and is applied to IF unit Q1 : MC3359P

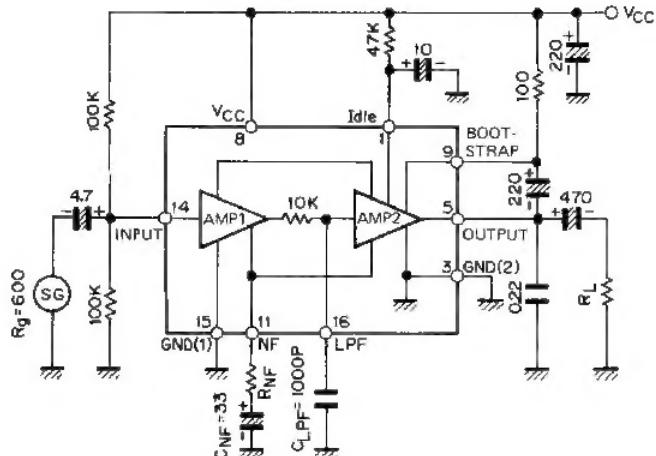


Fig. 1 TA7331F Block diagram (IF unit Q2)

Item	Rating
Noninal center frequency (f <sub>0</sub> )	16.3MHz
Pass bandwidth	f <sub>0</sub> ± 7.5kHz or more at 3dB
Attenuation bandwidth	f <sub>0</sub> ± 25kHz or more at 18dB
Guaranteed attenuation	30dB or more within f <sub>0</sub> ± 1MHz Spurious : 15dB or more at f <sub>0</sub> ~ f <sub>0</sub> +500kHz.
Ripple	0.5dB or less
Insertion loss	1.0dB or less
Terminal impedance	1kΩ/1.5pF

**Table 2 MCF (L71-0426-05) (RF unit F1)**

Item	Rating
Center frequency of 6dB bandwidth (f <sub>0</sub> )	455kHz ± 1.5kHz
6dB bandwidth	± 7.5kHz or more
40dB bandwidth	± 15kHz or less
Ripple	1.5dB or less (455 ± 5kHz)
Guaranteed attenuation	27dB or more within f <sub>0</sub> ± 100kHz
Insertion loss	6dB or less at 455kHz
Terminal impedance	1.5kΩ

**Table 3 Ceramic filter (L72-0335-05) (IF unit F1)**

Q1 consists of the second mixer, second local oscillator, second IF amp, FM demodulator, squelch noise amp and control circuits.

The demodulated audio signal from Q1 is amplified by AF amplifier Q2 : TA7331F, on the IF unit, via the AF volume control (VR1 on the switch unit) to drive the speaker.

The squelch circuit, (an auxiliary circuit of the receiver section) detects the high frequency noise component of the demodulated audio output from Q1.

This signal is applied to pin 12 of Q1 via the squelch control, (VR2 on the switch unit). The noise component applied to pin 12, is amplified and then output at pin 13. The output at pin 13 is rectified by D1 and D2 : 1N60As and fed to pin 14. When this rectified voltage is applied to pin 14, the squelch trigger circuit functions, pin 16 is grounded, and Q4 : 2SC2412K and Q3 : 2SB698(E,F) turn OFF. When Q3 turns OFF, AF amp IC Q2 : TA7331F is muted and no audio is output. When a signal is received, the noise level contained in the demodulated output of Q1 reduced, and the squelch trigger circuit does not function. Therefore, Q4 and Q3 turn ON, the AF amp IC is powered, and audio output is obtained.

## CIRCUIT DESCRIPTION

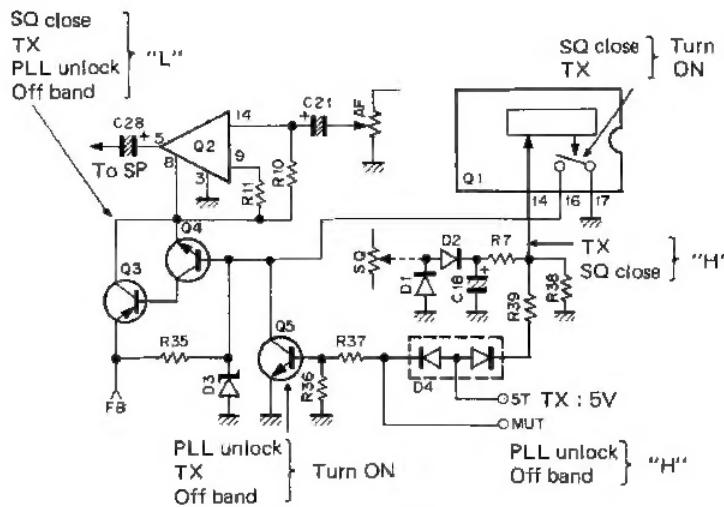


Fig. 2 Squelch-mute circuit

### TX Section

The VCO local oscillator Q14 : 2SC2714(Y) frequency in transmit is one half the actual TX frequency. The output of VCO buffer amp Q16 : 2SC2671(H) is doubled by Q5 : 2SC2668(Y) and fed through a BPF to obtain the TX frequency. The output of the BPF is fed to pre-driver, Q6 : 2SC2347, driver Q7 : 2SC2053, and is then amplified by the final amplifier Q8 : 2SC1947.

	V <sub>CEO</sub>	V <sub>EBO</sub>	V <sub>CEO</sub>	I <sub>C</sub>	P <sub>C</sub>	P <sub>C</sub>	T <sub>J</sub>	T <sub>SIG</sub>	T <sub>A</sub>
Test Conditions			R <sub>BE</sub> = $\approx 32$		T <sub>c</sub> = 25°C	T <sub>a</sub> = 25°C			25 $\pm 3^\circ\text{C}$
Maximum Rating	35V	4V	17V	1A	10W	1W	+175°C	-65 ~ +175°C	

Table 4 2SC1947 Max. rating (RF unit Q8)

Signals from the microphone and the tone circuits are amplified by mic amp Q6 : NJM4558M. The signal is then applied to voltage variable capacitor diode D16 : 1S2208 of the VCO circuit to modulate the VCO signal. The transmitter section also consists of the power selector circuit and the tone circuit.

To select the power, the emitter resistor R23 (10Ω) of driver Q7 is controlled by the HI/LO switch (S1) on the IF unit. When R23 is grounded, the output power is about 1W. When R23 is opened, the output power becomes about 150mW.

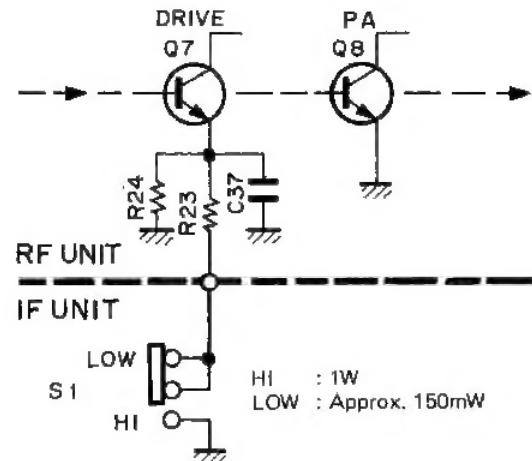


Fig. 3 Power select circuit

Several different tone circuits are available to provide access to repeaters. Circuits vary depending on country of destination.

- 1) In E (W) type models (for European countries), when the TONE switch (a non-locking type) is held depressed, the radio enters TX mode and a tone signal of 1750Hz is emitted.
- 2) In E (T) type models (for the United Kingdom), when the TONE switch is pressed, the radio will enter TX mode and a tone burst of 1750Hz is transmitted.
- 3) The optional tone encoder (TU-6) may be installed in A/AT versions. With the TU-6, any one of 37 frequencies between 67.0–250.3Hz can be transmitted. When the TONE switch is pressed, the tone signal is continuously transmitted.
- 4) In AT type models, a DTMF (Dual-Tone Multi Frequency) system is also used. When a key is pressed, the unit enters TX mode and transmits a dual tone signal as long as the key is held depressed.

## CIRCUIT DESCRIPTION

### PLL Circuit

In RX mode, the VCO oscillates at frequency of 1/2 the first local oscillator [63.85 – 65.8475MHz (T,W,X ; 63.85–64.845MHz)]. In TX mode, the VCO oscillates at a frequency of 1/2 the TX frequency [72–73.9975MHz (T,W,X ; 72 – 72.9975MHz)].

During reception, D15 turns ON to connect C104 into the oscillator circuit which causes the oscillation frequency of the VCO to drop.

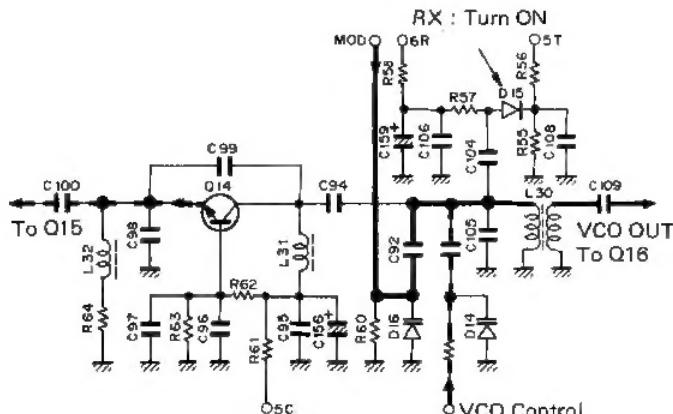


Fig. 4 VCO circuit

The output of the VCO is amplified by Q15 : 2SC2714(Y) and mixed with the HET oscillator Q9 : 2SC2714(Y) signal by PLL mixer Q10 : 2SC2668(Y).

The frequency of the HET oscillator is determined by the crystal selected by the OFFSET switch. Q9 in connection with BPF L25 and L26 acts as a frequency doubler.

The output of PLL mixer Q10 passes through a LPF (L28, C79, C80) to obtain a 2-3.995MHz signal (T,W,X ; 2-2.995MHz). This signal is amplified by Q11: 2SC2668(Y) and is applied to programmable counter Q3 : TC9122P. The signal input to Q11 is divided by 1/400 at 144.00MHz and 1/799 at 147.99MHz (T,W,X ; 1/599 at 145.99MHz). The actual divide ratio is determined by the thumb-wheel switch, (S2) on switch unit, settings.

The output of Q3 is compared with the (5kHz) reference signal by the phase comparator Q13 : TC5081AP. The 10.24MHz reference oscillator signal is divided by 1/2048 in Q12 : TC5082P to obtain the phase comparator reference frequency. The control voltage output of Q13 is fed through a passive type LPF to voltage variable capacitor diode D14 : ITT310TE of VCO circuit to control the VCO frequency.

Peripheral circuits of the PLL are the +5kHz circuit, and PLL unlock circuits. The +5kHz circuit is used to obtain the 5kHz TX and RX frequencies. In RX mode, when the 5k switch, S3 on switch unit, is set to off, D6 of the PLL HET oscillator circuit is forward biased effectively by passing. When the 5k switch is set to ON, the D6 turns off, which connects TC4 and C61 to crystal (X2) in series.

When a capacitor is connected to the crystal in series, the frequency of oscillation increases. Use TC4 to adjust the +5kHz frequency. The PLL unlock circuit is described in the control circuit section.

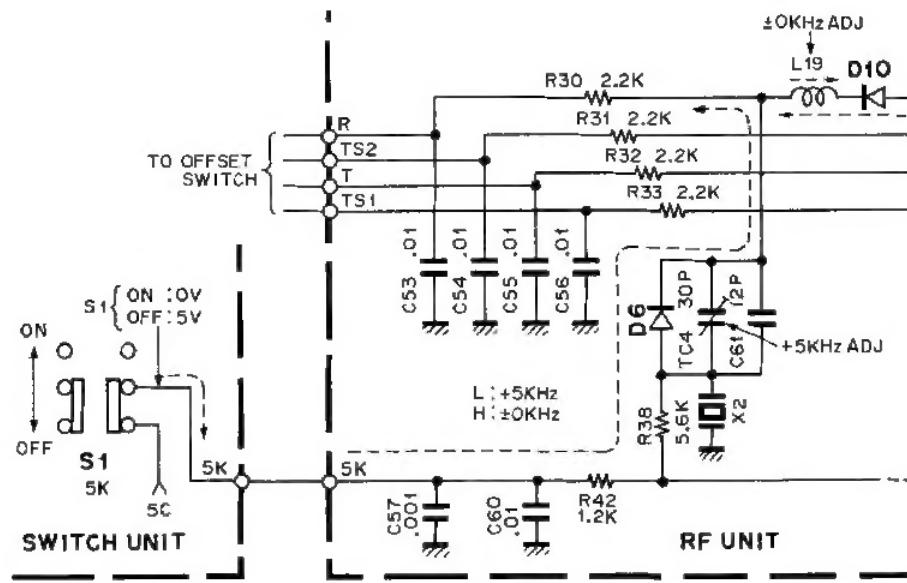
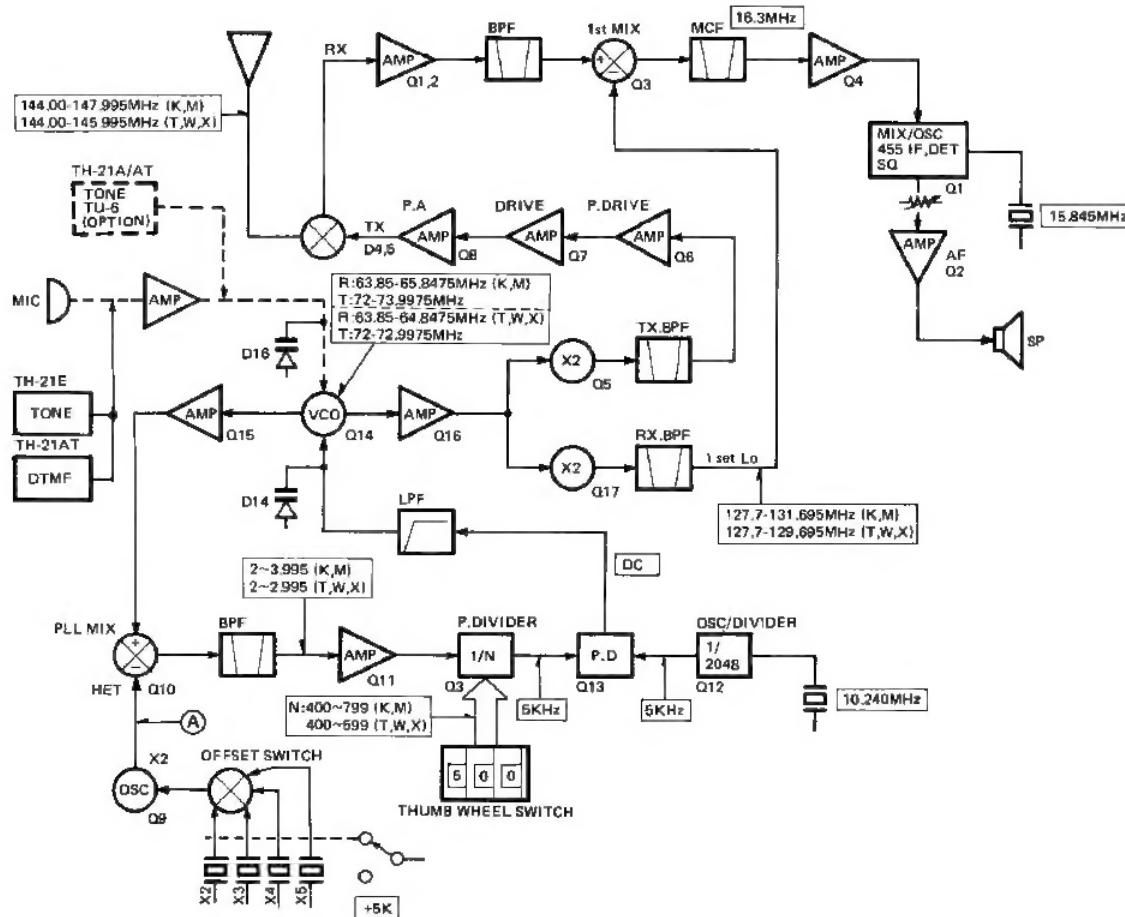


Fig. 5 +5kHz shift circuit

## CIRCUIT DESCRIPTION



(A) TH-21A/AT

OFF SET Switch				Crystal	
	-	S	+	X2	61.850MHz
	(600kHz)		(600kHz)	X3	70.300MHz
RX	X2	X2	X2	X4	70.000MHz
TX	X5	X4	X3	X5	69.700MHz

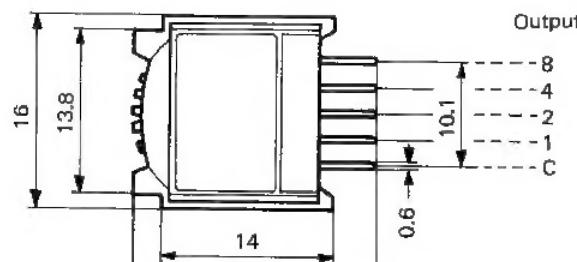
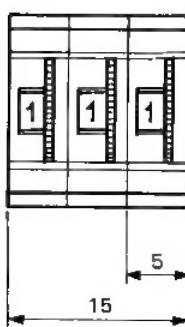
K,M,X Type

TH-21E

OFF SET Switch				Crystal	
	-	S	REV	X2	61.850MHz
	(600kHz)			X3	61.550MHz
RX	X2	X2	X3	X4	70.000MHz
TX	X5	X4	X4	X5	69.700MHz

T,W Type

Fig. 6 Frequency configuration



Dial	Output	● : Connect to the common pin			
		8	4	2	1
0					
1					●
2				●	
3				●	●
4			●		
5			●		●
6		●		●	
7		●	●	●	●
8	●				
9	●				●

Fig. 7 Thumb wheel switch (S59-3401-05) (Switch unit S2)

## CIRCUIT DESCRIPTION

## Control circuit

A constant regulated 5V is obtained from voltage regulator Q19 : LV517. The 5C signal is available in both TX and RX modes, and is used as a reference voltage on the 6R and 5T AVR's.

The 6R output of Q20 : 2SC1037K is supplied to the RX section and the 5T output is supplied to the TX section. When the PTT switch is pressed, Q7 : 2SA1037K and Q8 : 2SA2412K are forward biased, and the TC line is grounded to place the radio in transmit mode.

The function of the power supply circuit is described in the table below.

	TC	Q23	Q26	Q22	Q24	6R	5T
RX	H	ON	OFF	ON	OFF	○	X
TX	L	OFF	ON	OFF	ON	X	○

Table 5 Function of power supply circuit

In unlock mode (when PLL is unlocked), the unlock signal "H" is felt at pin 1 of Q13 : TC5081AP. The unlock signal passes through D17 : MA152WA/2, to control Q23 and Q26 and switches the radio to RX. When a frequency is selected out side the normal amateur band, the anti-lock signal (AL) "H" is generated in the switch unit and is applied to D22 : 1SS133 of RF unit, which also places the radio in RX.

When the unlock or anti-lock signal is generated, an logic "H" is fed to the MUT pin (of the IF unit) through D17/2 or D18 : 1SS133 to stop AF amp operation.

During transmitt, the 5T signal is replies to IF unit Q5 : 2SC2412K and Q1 : MC3359P via D4 : MA152WA to stop AF amp operation.

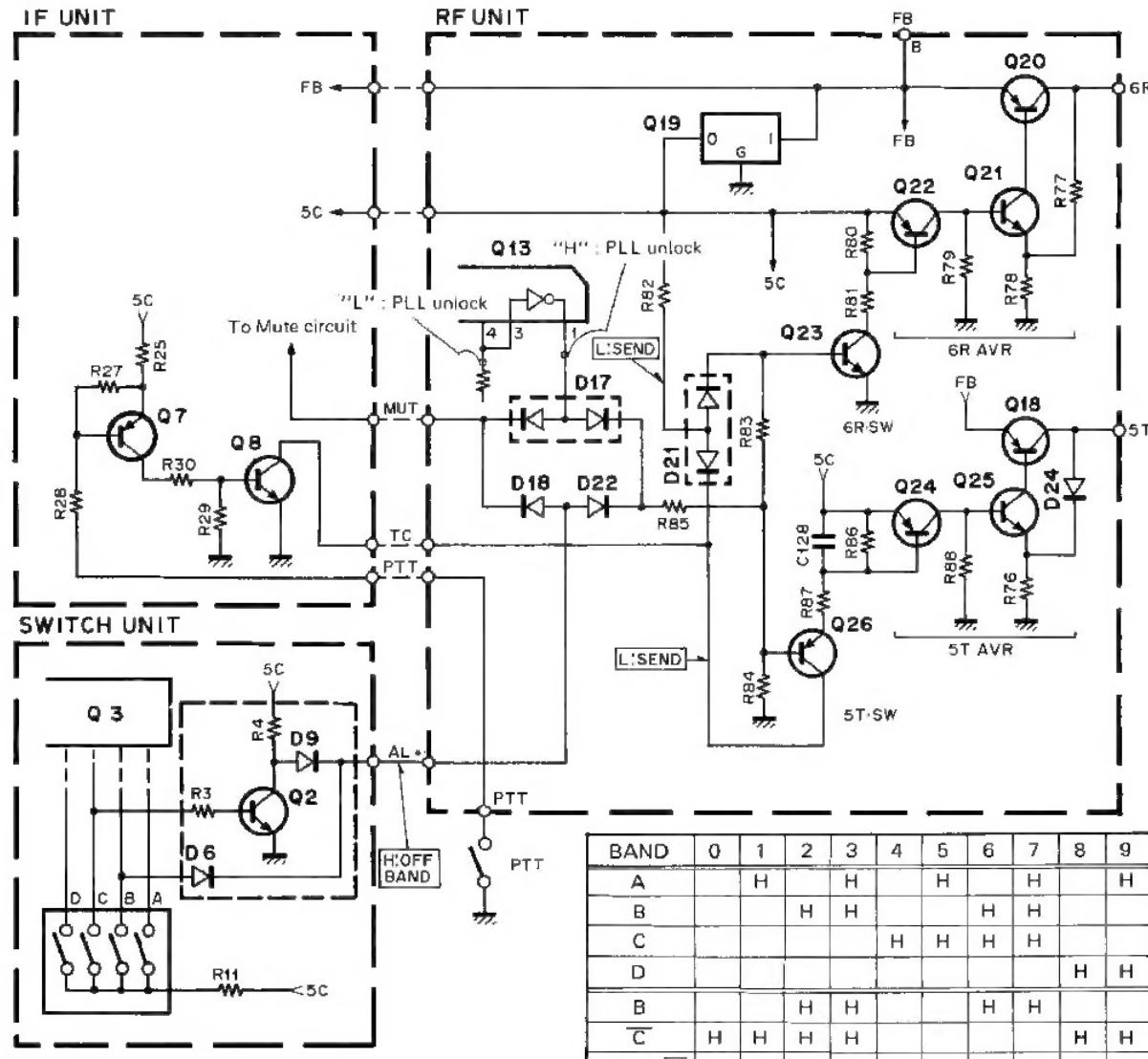


Fig. 8 Control circuit

## CIRCUIT DESCRIPTION/PACKING

Parts No.	W09-0334-05	W09-0335-05	W09-0336-05	W09-0339-05
Input power	AC 120V 60Hz 3W or less	AC 220V 50/60Hz 3W or less	AC 240V 50Hz 3W or less	AC 240V 50/60Hz 3W or less
Output	DC 8.7V 32mA at 0mA/13.5V or less			
Weight	Approx. 120g	Approx. 210g		
Destination	U.S.A	Europe/Gen. M1-4	United Kingdom	Australia/New Zealand
Ref'			TRIO Brand	

Table 6 Charger specifications

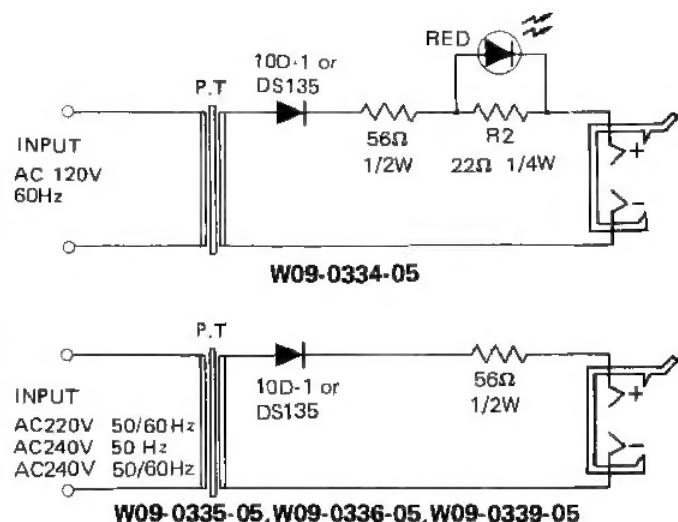
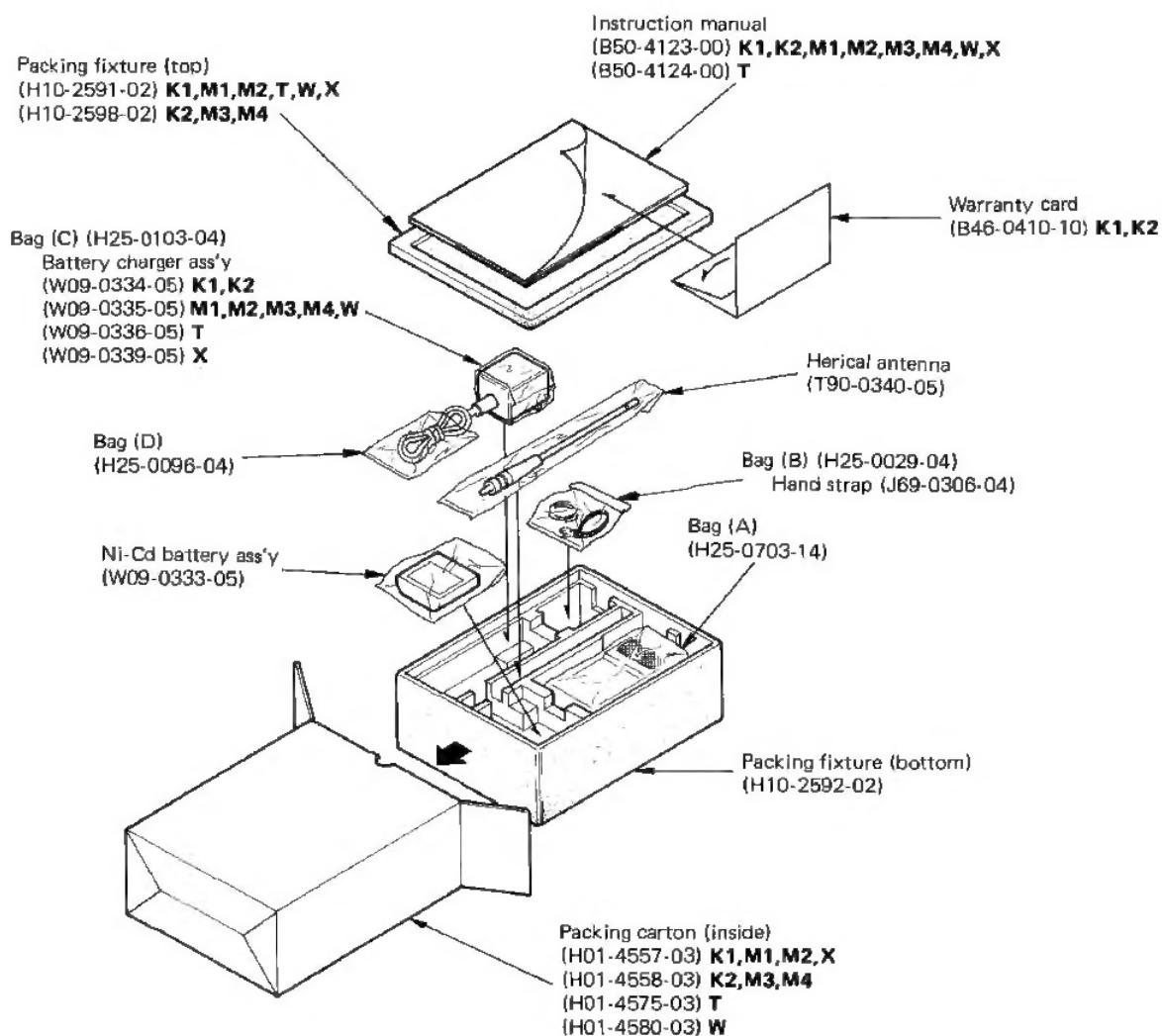


Fig. 9 Charger schematic diagram

## PACKING



## PARTS LIST

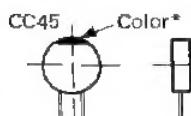
CAPACITORS	CC	45	TH	1H	220	J
	1	2	3	4	5	6

1 = Type ..... ceramic, electrolytic, etc.  
2 = Shape ..... round, square, etc.  
3 = Temp. coefficient

4 = Voltage rating  
5 = Value  
6 = Tolerance

## • Temperature Coefficient

1st Word	C	L	P	R	S	T	U
Color*	Black	Red	Orange	Yellow	Green	Blue	Violet
ppm/ $^{\circ}$ C	0	-80	-150	-220	-330	-470	-750



## • Capacitor value

0 1 0 = 1pF

1 0 0 = 10pF

1 0 1 = 100pF

1 0 2 = 1000pF = 0.001 $\mu$ F1 0 3 = 0.01 $\mu$ F

2 2 0 = 22pF

1st number | Multiplier  
2nd number

2nd Word	G	H	J	K	L
ppm/ $^{\circ}$ C	$\pm 30$	$\pm 60$	$\pm 120$	$\pm 250$	$\pm 500$

Example CC45TH = -470 $\pm$ 60 ppm/ $^{\circ}$ C

## • Tolerance

Code	C	D	G	J	K	M	X	Z	P	No code
(%)	$\pm 0.25$	$\pm 0.5$	$\pm 2$	$\pm 5$	$\pm 10$	$\pm 20$	$+40$	$+80$	$+100$	More than 10 $\mu$ F-10~+50
							-20	-20	-0	Less than 4.7 $\mu$ F-10~+75

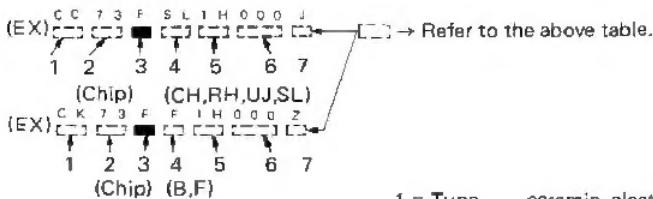
Code	B	C	D	F	G
(pF)	$\pm 0.1$	$\pm 0.25$	$\pm 0.5$	$\pm 1$	$\pm 2$

Less than 10 pF

## • Rating voltage

2nd word	A	B	C	D	E	F	G	H	J	K	V	
1st word	0	1.0	1.25	1.6	2.0	2.5	3.15	4.0	5.0	6.3	8.0	-
1	10	12.5	16	20	25	31.5	40	50	63	80	35	
2	100	125	160	200	250	315	400	500	630	800	-	
3	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	-	

## • Chip capacitors



## Dimension

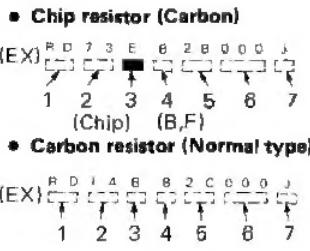
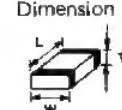
Dimension code	L	W	T
Empty	$5.6 \pm 0.5$	$5.0 \pm 0.5$	Less than 2.0
E	$3.2 \pm 0.2$	$1.6 \pm 0.2$	Less than 1.25
F	$2.0 \pm 0.3$	$1.25 \pm 0.2$	Less than 1.25

## Dimension

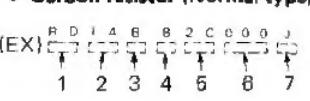
Dimension code	L	W	T	Wattage
E	$3.2 \pm 0.2$	$1.6 \pm 0.2$	0.57	2B
F	$2.0 \pm 0.3$	$1.25 \pm 0.2$	0.45	2A

## Rating wattage

Cord	Wattage	Cord	Wattage	Cord	Wattage
2A	1 10W	2E	1 4W	3A	1W
2B	1 8W	2H	1 2W	3D	2W
2C	1 6W				



1 = Type ..... ceramic, electrolytic, etc.  
2 = Shape ..... round, square, etc.  
3 = Dimension  
4 = Temp. coefficient  
5 = Voltage rating  
6 = Value  
7 = Tolerance.



Model	Destination	Switch unit	RF unit	IF unit	Tone unit	Touch tone unit
TH-21A	K1 · M1 M2 · X	X41-1590-11 X41-1590-71	X44-1630-11 X44-1630-71	X48-1410-11		
TH-21AT	K2 · M3 M4	X41-1590-11 X41-1590-71	X44-1630-11 X44-1630-71	X48-1410-11		A09-0402-05
TH-21E	T W	X41-1590-51 X41-1590-61	X44-1630-61	X48-1410-61	X41-1270-51 X41-1270-60	

## TH-21A/AT/E GENERAL

N : New parts

\* : Please note that parts are sometimes not in stock and it takes much time to deliver.

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# TH-21A/AT/E

## PARTS LIST

PART. NO	NOTE	NAME & DESCRIPTION	DISTINCTION				REFERENCE. NO
			011	012	021	022	
A02-0670-02	N*	CASE (TOP)	144MHz. KENWOOD	1	1	1	K1 - 011
A02-0671-02	N*	CASE (TOP)	144MHz. TRIO				K2 - 012
A02-0670-02	N*	CASE (TOP)	144MHz. KENWOOD				
A02-0672-01	N*	CASE (TOP)	144MHz. KENWOOD	1	1	1	
A02-0675-02	N*	CASE (BOTTOM)		1	1	1	
A09-0407-03	N*	CASE (TOP) ASSY	144MHz. KENWOOD	1	1	1	
A09-0402-05	N*	CASE (TOP) ASSY *	WITH DTMF	1	1	1	M1 - 021
A09-0407-03	N*	CASE (TOP) ASSY	144MHz. KENWOOD	1	1	1	M2 - 022
A09-0402-05	N*	CASE (TOP) ASSY *	WITH DTMF	1	1	1	M3 - 023
A09-0407-03	N*	CASE (TOP) ASSY	144MHz. TRIO	1	1	1	M4 - 024
A09-0407-03	N*	CASE (TOP) ASSY	144MHz. KENWOOD	1	1	1	
A21-0768-02	N*	ORNAMENTAL PANEL		1	1	1	T - 051
B04-0408-04	N*	SP METAL		1	1	1	
B04-0409-04	N*	SP METAL		1	1	1	X - 071
B04-0408-04	N*	SP METAL		1	1	1	
B04-0409-04	N*	SP METAL		1	1	1	
B04-0408-04	N*	SP METAL		1	1	1	
B05-0773-04	N*	SP GRILLE		1	1	1	
B40-3510-04	N*	MODEL NAME PLATE TH-21A		1	1	1	
B40-3534-04	N*	MODEL NAME PLATE TH-21AT		1	1	1	
B40-3510-04	N*	MODEL NAME PLATE TH-21A		1	1	1	
B40-3534-04	N*	MODEL NAME PLATE TH-21AT		1	1	1	
B42-2343-04	N*	FCC PLATE		1	1	1	
B42-2359-04	N*	FCC PLATE		1	1	1	
B42-2359-04	N*	FCC PLATE		1	1	1	
B42-1745-04	N*	SERIAL NO. LABEL		1	1	1	
B42-2379-04	N*	PLATE HI/LO/- S +		1	1	1	
B42-2366-04	N*	PLATE HI/LO/- S +		1	1	1	
B42-2366-04	N*	BADGE TH-21A		1	1	1	
B43-1025-04	N*	BADGE TH-21AT		1	1	1	
B43-1029-04	N*	BADGE TH-21A		1	1	1	
B43-1029-04	N*	BADGE TH-21AT		1	1	1	
B43-1032-04	N*	BADGE TH-21E		1	1	1	
B43-1025-04	N*	BADGE TH-21A		1	1	1	
B50-4123-00	N	INSTRUCTION MANUAL		1	1	1	
B50-4124-00	N	INSTRUCTION MANUAL		1	1	1	
B50-4123-00	N	INSTRUCTION MANUAL		1	1	1	
CC45SL1H560J	CERAMIC	56P 50V		1	1	1	C - 101
CC73UCH1H3000J	CHIP CAP.	30P 50V		2	2	2	C - 6
CE04CWOJ100M	ELECTRO	10 6.3V		2	2	2	C - 2
CE04CW1C4R7M	ELECTRO	4.7 16V		1	1	1	C - 5
CK73OBIE103K	CHIP CAP.	0.01 25V		2	2	2	C - 1, 3
E23-0432-04	N	TERMINAL FOR JUNCTION (INSIDE)					
E23-0458-04	N	TERMINAL FOR JUNCTION (INSIDE)					
E23-0432-04	N	TERMINAL (INSIDE)					
F10-1314-04	N*	SHIELDING PLATE		1	1	1	
F19-0637-04	N*	SWITCH MASK(A) HI/LO		1	1	1	
F19-0638-04	N*	SWITCH MASK(B) OFFSET		1	1	1	

## PARTS LIST

PART. NO	NOTE	NAME & DESCRIPTION	DISTINCTION & QUANTITY							REFERENCE. NO
			011	012	021	022	023	024	051	
F20-0520-04	*	CUSHION(B) SP INSULATING BOARD	1	1	1	1	1	1	1	1
F20-0538-04	N*		1	1	1	1	1	1	1	1
GL9PR24	N	LED RED RF. UNIT	1	1	1	1	1	1	1	1
G10-0633-04	N*	TAPE CUSHION FOR JUNCTION	2	2	2	2	2	2	2	2
G11-0802-04	N*	CUSHION MIC	1	1	1	1	1	1	1	1
G11-0626-04	*	CUSHION FOR JUNCTION	2	2	2	2	2	2	2	2
G11-0802-04	N*	CUSHION(B) FOR PTT	1	1	1	1	1	1	1	1
G11-0803-04	N*									
H01-4557-13	N*	CARTON(INSIDE)	1							
H01-4558-13	N*	CARTON(INSIDE)	1	1	1	1	1	1	1	1
H01-4557-13	N*	CARTON(INSIDE)								
H01-4558-13	N*	CARTON(INSIDE)								
H01-4575-13	N*	CARTON(INSIDE)								
H01-4580-13	N*	CARTON(INSIDE)								
H01-4557-13	N*	CARTON(INSIDE)								
H10-2591-02	N*	PACKING FIXTURE(CTOP)	1	1	1	1	1	1	1	1
H10-2598-02	N*	PACKING FIXTURE(BOTTOM)	1	1	1	1	1	1	1	1
H10-2598-02	N*	PACKING FIXTURE(CTOP)	1	1	1	1	1	1	1	1
H25-0703-1	*	BAG(TH-21 BODY)140X190	1	1	1	1	1	1	1	1
H25-00229-04	*	BAG(ACSSY) 60X110	1	1	1	1	1	1	1	1
H25-0103-04	*	BAG(CHARGER) 125X250	1	1	1	1	1	1	1	1
H25-0096-04	*	BAG(BATTERY) 100X110	1	1	1	1	1	1	1	1
J25-3251-05	N	FLEXIBLE PC BOARD RF-IF	1	1	1	1	1	1	1	1
J32-0785-04	N	ROUND BOSS M2X6	2	2	2	2	2	2	2	2
J39-0409-14	*	MIC. SPACER	1	1	1	1	1	1	1	1
J69-0306-04	N	HAND SPACER (ACS)	1	1	1	1	1	1	1	1
J69-0309-05	N	O RING	2	2	2	2	2	2	2	2
K27-0468-04	N	PUSH KNOB(A) TONE	1	1	1	1	1	1	1	1
K27-0469-04	N	PUSH KNOB(B) +5KHZ	1	1	1	1	1	1	1	1
K29-3012-04	N	KNOB(A) AF	1	1	1	1	1	1	1	1
K29-3013-04	N	KNOB(B) SQL	1	1	1	1	1	1	1	1
K29-3014-04	N	PTT LEVER	1	1	1	1	1	1	1	1
LR40872	N	IC	1							
L78-0010-05	N	CRYSTAL 3.58MHZ	1	1	1	1	1	1	1	1
N09-0683-05	N	SPECIAL SCREW M2 X4	2	2	2	2	2	2	2	2
N30-2004-41		PAN HD SCREW(SWITCH PC BOARD)	1	1	1	1	1	1	1	1
N33-2005-45		ROUND FLAT SCREW(CASE:TOP)	3	3	3	3	3	3	3	3
N33-2008-45		ROUND FLAT SCREW(CASE:TOP)	1	1	1	1	1	1	1	1
N35-2005-45		ROUND FLAT SCREW(CASE:BOTTOM)	2	2	2	2	2	2	2	2
RD73FB2A473J		CHIP RES. 47K OHM 1/10W	5							
RD73FB2A154J		CHIP RES. 150KOHM 1/10W	1							
R12-3449-05		TRIM.POT 10K	4							
T07-0235-05	N	SPEAKER	1	1	1	1	1	1	1	1
T18-0054-05	N	EARPHONE ANTENNA(ACS)	1	1	1	1	1	1	1	1
T90-0340-05	N	EARPHONE	1	1	1	1	1	1	1	1
T91-0312-15	N	ELECTRIC CONDENSER MIC	1	1	1	1	1	1	1	1
W09-0334-05	N	BATTERY CHARGER ASS'Y 120V	1	1	1	1	1	1	1	1
W09-0335-05	N	BATTERY CHARGER ASS'Y 220V								

## PARTS LIST

PART. NO.	NOTE	NAME & DESCRIPTION	DISTINCTION & QUANTITY						REFERENCE-NO.
			011	012	021	022	023	024	
W09-0336-05	N	BATTERY CHARGER ASS'Y 240V						1	1
W09-0335-05	N	BATTERY CHARGER ASS'Y 220V						1	1
W09-0339-05	N	BATTERY CHARGER ASS'Y 240V						1	1
W09-0333-05	N	NI-CD BATTERY ASS'Y						1	1
X41-1590-11	N*	SWITCH UNIT			1	1			
X41-1590-71	N*	SWITCH UNIT				1			
X41-1590-11	N*	SWITCH UNIT				1			
X41-1590-71	N*	SWITCH UNIT				1			
X41-1590-51	N*	SWITCH UNIT				1			
X41-1580-61	N*	SWITCH UNIT				1			
X41-1590-71	N*	SWITCH UNIT				1			
X44-1630-11	N*	RF UNIT			1	1	1		
X44-1630-71	N*	RF UNIT				1			
X44-1630-11	N*	RF UNIT				1			
X44-1630-71	N*	RF UNIT				1			
X44-1630-61	N*	RF UNIT				1			
X44-1630-71	N*	RF UNIT				1			
X44-1410-11	N*	IF UNIT			1	1	1		
X48-1410-61	N*	IF UNIT				1			
X48-1410-11	N*	IF UNIT				1			
X52-1270-51	N*	TONE UNIT				1			
X52-1270-60	N*	TONE UNIT				1			
ZSA1037K(Q)		CHIP TR.			1		1		
ZSA1162(Y)		CHIP TR.				1			
ZSC2412K(Q)		CHIP TR.			1		1		
ZSC2712(Y)		CHIP TR.				1			

### SEMICONDUCTOR

Item	Re. marks	Part No.
IC		LR4087/2 LVC517
		MC3369P
		NJM555M NJM4558M
		TA7331F TC5081AP TC5081P TC5082P TC9122P

Item	Re. marks	Part No.
TR		2SB698(E,F)
		2SC1947
		2SC2053
		2SC2347
		2SC2668(Y)
		2SC2671(H)
Chip TR		2SA1037K(Q)
		2SA1037K(R)
		2SA1162(G)
		2SA1162(Y)
		2SC2412K(Q)
		2SC2712(Y)
		2SC2714(Y)
FET		2SK192A(Y)

Item	Re. marks	Part No.
Diode		1S1655
		1S2688
		1SS133
		BA282
		MA866
		MI301
Vari-cap		1S2208
		ITT310TE
Zener Diode		MT268JB
LED		GL9PR24
Chip Diode		MA152WA MA152WK

## PARTS LIST

## SWITCH UNIT (X41-1590-XX) {-11 : K1,K2,M1,M3 -51 : T -61 : W -71 : M2,M4,X}

PART. NO	NOTE	NAME & DESCRIPTION	DISTINCTION & QUANTITY		REFERENCE - NO
			011	051	
CK73FB1H102K		CHIP CAP.	1000P 50V	14 14	14
133-0682-05	N	CHOKER COIL		1 1	1
192-0110-05		FERRITE CORE		1 1	1
WA152WK		CHIP DIODE		2 2	2
RD14CB2C1013		RES. CARBON	100 OHM 1/6W	1 1	1
RD14CB2C1013		RES. CARBON	100 OHM 1/6W	1	1
RD14CB2C103J		RES. CARBON	10K OHM 1/6W	1	1
RD14CB2C103J		RES. CARBON	10K OHM 1/6W	1	1
RD73FB2A473J		CHIP RES.	47K OHM 1/10W	1	2
RD73FB2A473J		CHIP RES.	47K OHM 1/10W	1	2
RD73FB2A102J		CHIP RES.	1K OHM 1/10W	1	2
RO5-3427-15	N	POTENTIOMETER	10K (B3) WITH SW	1 1	1
RO5-3428-05	N	POTENTIOMETER	10K (B3)	1 1	1
R92-0670-05		CHIP RES.	0 OHM	3	1
R92-0670-05		CHIP RES.	0 OHM	4	4
S40-2445-05		PUSH SWITCH(SELF LOCK)		2 2	2
S40-2445-05		PUSH SWITCH(SELF LOCK)		1	1
S40-2446-05		PUSH SWITCH(NON LOCK)		1	1
S59-3401-05	N	THUMB WHEEL SWITCH		1	1
TC9122P		IC		1 1	1
155133		DIODE		2	2
155133		DIODE		2	2
2SC2412K(Q)		CHIP TR.		1	1
2SC2412K(Q)		CHIP TR.		1	1
2SC2712(Y)		CHIP TR.		1	1
2SC2712(Y)		CHIP TR.		1	1

**PARTS LIST**

RF UNIT (X44-1630-XX) (-11 : K1,K2,M1,M3 -61 : T,W -71 : M2,M4,X)

PART. NO.	NOTE	NAME & DESCRIPTION	DISTINCTION & QUANTITY			REFERENCE-NO
			011 061 071	4	4	
BA282		DIODE DIODE				L 10, 11, 12, 13
BA2B2						L 10, 12, 13, 23
CC45CH1H090D		CERAMIC CERAMIC	9P 50V	1	1	C 51
CC45CH1H150J		CHIP CAP.	15P 50V	1	1	C 52
CC73FCH1H330J		CHIP CAP.	33P 50V	2	2	C 28, 48
CC73FCH1H100D		CHIP CAP.	10P 50V	12	12	C 8, 12, 22, 25, 27, 32, 62
CC73FCH1H100D		CHIP CAP.	10P 50V	11		C 63, 64, 109, 113, 118
CC73FCH1H120J		CHIP CAP.	10P 50V			C 8, 12, 22, 25, 27, 32, 63
CC73FCH1H2560J		CHIP CAP.	39P 50V	3	3	C 64, 109, 113, 118
CC73FCH1H010C		CHIP CAP.	1P 50V	4	4	C 42, 79, 80
CC73FCH1H185C		CHIP CAP.	1.5P 50V	2	2	C 26, 33, 92, 117
CC73FCH1H470J		CHIP CAP.	4.7P 50V	2	2	C 11, 13
CC73FCH1H120J		CHIP CAP.	12P 50V	2	2	C 35, 74
CC73FCH1H560J		CHIP CAP.	56P 50V	3	3	C 99, 116
CC73FCH1H030C		CHIP CAP.	3P 50V	1	1	C 70, 72, 103
CC73FCH1H680J		CHIP CAP.	6.8P 50V	2	2	C 49
CC73FCH1H050C		CHIP CAP.	5P 50V	5	5	C 40, 69
CC73FCH1H150J		CHIP CAP.	1.5P 50V	2	2	C 73, 75, 76, 100, 105
CC73FSL1H121J		CHIP CAP.	120P 50V	3	3	C 104, 158
CC73FCH1H4070D		CHIP CAP.	7P 50V	2	2	C 3, 5, 119
CC73FCH1H180J		CHIP CAP.	18P 50V	3	3	C 4, 14
CC73FCH1H090D		CHIP CAP.	9P 50V	1	1	C 86, 87, 98
CC73FCH1H220J		CHIP CAP.	22P 50V	1	1	C 34
CC73FCH1H270J		CHIP CAP.	27P 50V	2	2	C 94
CE04CW1A330M		ELECTRO	33 10V	1	1	C 39, 50
CE04CW1A101M		ELECTRO	100 10V	2	2	C 133
CE04CW1C100M		ELECTRO	10 16V	1	1	C 132, 155
CE04CW1C4R7M		ELECTRO	4.7 16V	2	2	C 88
CE04CW1C470M		ELECTRO	4.7 16V	1	1	C 45, 159
CE04CW1E3R5M		ELECTRO	3.3 25V	1	1	C 120
CE04CW1V2R2M		ELECTRO	2.2 35V	1	1	C 134
CE04CW0J100M		ELECTRO	10 6.3V	1	1	C 156
CE04CW1H010M		ELECTRO	1 50V	1	1	C 91
CE04CW0J470M		ELECTRO	4.7 6.3V	1	1	C 121
CE04CW1E4R7M		ELECTRO	4.7 25V	1	1	C 122
CK73FB1H102K		CHIP CAP.	1000P 50V	64	64	C 128
CK73FB1H102K		CHIP CAP.	1000P 50V			C 1, 7, 9, 10, 18, 19, 21
CK73FB1H102K		CHIP CAP.	1000P 50V			C 23, 24, 29, 30, 31, 36, 37
CK73FB1H222K		CHIP CAP.	2200P 50V	1	1	C 38, 41, 44, 46, 47, 57, 67
CK73FB1H472K		CHIP CAP.	4700P 50V	4	4	C 68, 71, 77, 78, 82, 84, 85
CK73FB1E103K		CHIP CAP.	0.01 25V	10	10	C 89, 90, 93, 95, 96, 97, 106
CK73FB1E223K		CHIP CAP.	0.022 25V	2	2	C 107, 108, 110, 111, 112, 114, 115
CK73FB1H471K		CHIP CAP.	470P 50V	2	2	C 125, 126, 129, 130, 131, 135, 136
C05-0327-05		TRIMMER	20P			C 137, 138, 139, 140, 141, 142, 144
C05-0320-05		TRIMMER	30P	5	5	C 20, 150
C90-0891-05		TANTALUM	4.7 16V	1	1	C 6, 81
						TC 2, 3
						TC 1, 4, 5, 6, 7
						C 151

# TH-21A/AT/E PARTS LIST

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PART. NO.	NOTE	NAME & DESCRIPTION	DISTINCTION & QUANTITY		REFERENCE. NO
			011-061	071	
E13-0165-05	N	RCA RECEPTACLE ANT. J	1	1	J - 1
F11-0873-04	N*	SHIELD COVER (VC0)	1	1	
IT1310TE		VOLTAGE VARIABLE	1	1	D - 14
IVC517	IC	WIDE BAND TRANS 12T	1	1	Q - 19
L19-0354-05	N	OSC COIL	4	4	L - 33
L32-0672-05	N	TUNING COIL VCO 70MHZ	1	1	L - 19, 20, 21, 22
L34-2226-05	N	TUNING COIL 140MHZ	11	11	L - 30
L34-2223-05	N	TUNING COIL 140MHZ	11	11	L - 6, 7, 8, 10, 11, 12, 13
L34-2224-05	N	TUNING COIL 16-3MHZ	1	1	L - 25, 26, 35, 36
L34-2225-05	N	TUNING COIL 140MHZ	2	10T	L - 9
L34-0893-05		COIL	3	4T	L - 5
L34-0894-05		COIL	3	5T	L - 4
L34-0895-05		COIL	3	6T	L - 2, 16, 17
L34-1061-05	N	COIL	3	2T	L - 14
L34-1105-05	N	COIL	3	4T ANT	L - 15
L40-3382-17		INDUCTOR 0.33UH	1	1	L - 1
L40-1092-17		INDUCTOR 1UH	2	2	L - 34
L40-3391-17		INDUCTOR 3.3UH	1	1	L - 3, 18
L40-5691-17		INDUCTOR 5.6UH	1	1	L - 32
L40-1501-17		INDUCTOR 15UH	1	1	L - 31
L40-4701-17		INDUCTOR 47JK	5	5	L - 28
L40-1011-17		INDUCTOR 100UH	2	2	L - 40, 41, 42, 43
L71-0246-05	N	MCV	16-3MHZ	1	L - 27, 37
L77-1234-05	N	XTAL	10-24MHZ	1	F - 4
L77-1235-05	N	XTAL	30-925MHZ RX(S)	1	X - 1
L77-1236-05	N	XTAL	35-000MHZ TX(S)	1	X - 2
L77-1239-05	N	XTAL	35-150MHZ TX(+)	1	X - 4
L77-1237-05	N	XTAL	30-775MHZ RX(-)	1	X - 3
L77-1239-05	N	XTAL	35-150MHZ TX(+)	1	X - 3
L77-1238-05	N	XTAL	34-850MHZ TX(-)	1	X - 5
L92-0110-05		FERRITE CORE	2	2	L - 38, 39
MA152WA		CHIP DIODE	2	2	D - 17, 21
MA856		DIODE	5	5	D - 6, 7, 8, 9, 15
MI301		DIODE	1	1	D - 4
RD14CB2C220J		RES. CARBON	22 OHM 1/6W	1	R - 26
RD14CB2C470J		RES. CARBON	47 OHM 1/6W	1	R - 22
RD14BB2C560J		RES. CARBON	56 OHM 1/6W	2	R - 9, 47
RD14CB2C23J		RES. CARBON	22K OHM 1/6W	1	R - 58
RD14BB2C822J		RES. CARBON	8-2KOHM 1/6W	1	R - 13
RD14CB2C103J		RES. CARBON	10K OHM 1/6W	1	R - 56
RD14BB2C222J		RES. CARBON	2-2KOHM 1/6W	3	R - 36
RD14BB2C59J		RES. CARBON	3-9KOHM 1/6W	1	R - 35
RD14BB2C225J		RES. CARBON	22K OHM 1/6W	1	R - 16
RD14CB2C472J		RES. CARBON	4-7KOHM 1/6W	2	R - 99, 100
RD14BB2C104J		RES. CARBON	100KOHM 1/6W	1	R - 93
RD14BB2C334J		RES. CARBON	330KOHM 1/6W	1	R - 14
RD73FB2A330J		CHIP RES.	33 OHM 1/10W	1	R - 20
RD73FB2A71J		CHIP RES.	270 OHM 1/10W	1	R - 3, 8, 12, 49, 57, 66
RD73FB2A22J		CHIP RES.	2-2KOHM 1/10W	6	R - 48, 55, 62, 63, 78, 79, 85
RD73FB2A103J		CHIP RES.	10K OHM 1/10W	8	

**PARTS LIST**

PART-NO	NOTE	NAME & DESCRIPTION	DISTINCTION & QUANTITY		REFERENCE-NO	
			011	061		
RD73FB2A173J		CHIP RES.	47K OHM 1/10W	4	4	R / 88
RD73FB2A131J		CHIP RES.	330 OHM 1/10W	2	2	R / 52, 83, 84, 94
RD73FB2A163J		CHIP RES.	36K OHM 1/10W	1	1	R / 15, 29
RD73FB2A170J		CHIP RES.	47 OHM 1/10W	1	1	R / 43
RD73FB2A123J		CHIP RES.	12K OHM 1/10W	2	2	R / 17
RD73FB2A160J		CHIP RES.	56 OHM 1/10W	1	1	R / 89, 92
RD73FB2A171J		CHIP RES.	470 OHM 1/10W	4	4	R / 7
RD73FB2A104J		CHIP RES.	100KOHM 1/10W	1	1	R / 4, 6, 46, 50
RD73FB2A172J		CHIP RES.	12.7KOHM 1/10W	2	2	R / 54
RD73FB2A153J		CHIP RES.	15K OHM 1/10W	2	2	R / 27, 67
RD73FB2A154J		CHIP RES.	150KOHM 1/10W	1	1	R / 19, 59
RD73FB2A132J		CHIP RES.	3.3KOHM 1/10W	1	1	R / 72
RD73FB2A101J		CHIP RES.	100 OHM 1/10W	7	7	R / 1, 10, 18, 21, 44, 73, 73
RD73FB2A481J		CHIP RES.	680 OHM 1/10W	1	1	R / 90
RD73FB2A211J		CHIP RES.	820 OHM 1/10W	2	2	R / 11
RD73FB2A183J		CHIP RES.	18K OHM 1/10W	1	1	R / 45, 70
RD73FB2A224J		CHIP RES.	220KOHM 1/10W	2	2	R / 44
RD73FB2A172J		CHIP RES.	4.7KOHM 1/10W	3	3	R / 51, 82
RD73FB2A334J		CHIP RES.	330KOHM 1/10W	1	1	R / 76, 80, 86
RD73FB2A223J		CHIP RES.	22K OHM 1/10W	2	2	R / 65
RD73FB2A222J		CHIP RES.	2.2 OHM 1/10W	1	1	R / 81, 87
RD73FB2A121J		CHIP RES.	1.2KOHM 1/10W	3	3	R / 96
RD73FB2A151J		CHIP RES.	5.6KOHM 1/10W	7	7	R / 42, 91, 61
RD73FB2A100J		CHIP RES.	150 OHM 1/10W	1	1	R / 24
RD73FB2A220J		CHIP RES.	22 OHM 1/10W	1	1	R / 23
RD73FB2A822J		CHIP RES.	8.2KOHM 1/10W	3	3	R / 28
R92-0670-05		CHIP RES.	0 OHM	2	2	R / 5, 36, 37
R92-0150-05		JUMPER WIRE		1	1	R / 97, 98
S50-1425-05	N	TACT SWITCH	PTT	1	1	JP / 1
TC5082D	IC			1	1	S / 1
TC5081AP	N			1	1	G / 12
ISS133	DIODE			4	4	G / 13
1S5133	DIODE			1	6	D / 2, 19, 20, 24
1S1555	DIODE			1	1	D / 3
1S2588	DIODE			1	1	D / 5
1S2208	VOLTAGE VARIABLE			1	1	D / 16
2SA1037(K)	N	CHIP TR.		2	2	G / 20, 26
2SA1162(Y)		CHIP TR.		2	2	G / 20, 26
2SA1037(KR)		CHIP TR.		5	5	G / 22, 24
2SA1162(GR)		CHIP TR.		1	1	G / 22, 24
2SB698(E,F)	TR			4	4	G / 18
2SC2714(Y)	CHIP TR.			4	4	G / 4, 9, 14, 15
2SC1947	TR			1	1	G / 8
2SC2053	TR			1	1	G / 7
2SC2347	TR			1	1	G / 6
2SC2668(Y)				5	5	G / 2, \$ 10, 11, 17
2SC2671(H)	TR			2	2	G / 1, 16
2SC2412(KQ)	CHIP TR.			4	4	G / 21, 23, 25, 27
2SC2712(Y)	CHIP TR.			1	1	G / 23, 25, 27
2SK192A(Y)	FET			1	1	G / 3

# TH-21A/AT/E PARTS LIST

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IF UNIT (X48-1410-XX) {-11 : K1,K2,M1,M2,M3,M4,X -61 : T,W)

PART. NO	NOTE	NAME & DESCRIPTION	DISTINCTION & QUANTITY		REFERENCE. NO
			011	061	
CC73FCH1H270J		CHIP CAP.	270P	50V	1 1
CC73FSL1H101J		CHIP CAP.	100P	50V	5 5
CC73FSL1H151J		CHIP CAP.	150P	50V	1 1
CC73FSL1H391		CHIP CAP.	390P	50V	1 1
CE04C0J330M		ELECTRO	33	6-3V	1 1
CE04C0W1A100M		ELECTRO	10	10V	2 2
CE04C1C4R7W		ELECTRO	4.7	16V	1 1
CE04Cw1V2R2M		ELECTRO	2.2	35V	4 4
CK45B1H102K		CERAMIC	1000P	50V	1 1
CK73FB1H102K		CHIP CAP.	1000P	50V	20 20
CK73FB1E273K		CHIP CAP.	0.027	25V	1 1
CK73FB1H272K		CHIP CAP.	2700P	50V	1 1
CK73F1F473Z		CHIP CAP.	0.047	25V	3 3
CK73FB1H68K		CHIP CAP.	6800P	50V	1 1
CK73FB1E223K		CHIP CAP.	0.022	25V	2 2
C90-0888-05		TANTALUM	0.1	16V	1 1
C90-0889-05		TANTALUM	0.22	16V	1 1
C90-0890-05	A	TANTALUM	0.33	16V	1 1
C90-0894-05		TANTALUM	0.47	16V	1 1
C90-2007-05	N	TANTALUM	3.3	16V	1 1
C90-2012-05		ELECTRO	100	10V	3 3
C90-0891-05		CERAMIC	4.7	16V	1 1
C91-0488-05		CERAMIC	0.1	2	2
C91-030-05		LAYER CAP.	0.047	16V	1 1
C92-1035-05		FLM CAP.	0.22	63V	1 1
F11-0420-05	N	MIC JACK		1	1
E11-0421-05	N	PHONE JACK		1	1
L34-2217-05		TUNING COIL	455KHZ	1	1
L72-0335-05		CERAMIC FILTER	CFLU455E	1	1
L77-1240-05	N	CRYSTAL	15.845MHZ	1	1
MA152W	N	CHIP DIODE		1	1
MC3359P		TC		1	1
MT26.8..B		ZENER DIODE	6.8V	1	1
NJMM655BM		IC		1	1
RD14CB2C472		RES. CARBON	4.7KOHM 1/6W	2	2
RD14CB2C103		RES. CARBON	10K OHM 1/6W	2	2
RD14CB2C104		RES. CARBON	100KOHM 1/6W	1	1
RD14CB2C684		RES. CARBON	680KOHM 1/6W	1	1
RD73FB2A102J		CHIP RES.	1K OHM 1/10W	3	3
RD73FB2A152J		CHIP RES.	1.5KOHM 1/10W	1	1
RD73FB2A473J		CHIP RES.	47K OHM 1/10W	4	4
RD73FB2A222J		CHIP RES.	2.2KOHM 1/10W	1	1
RD73FB2A823J		CHIP RES.	82K OHM 1/10W	1	1
RD73FB2A273J		CHIP RES.	27K OHM 1/10W	1	1
RD73FB2A470		CHIP RES.	47 OHM 1/10W	1	1
RD73FB2A104		CHIP RES.	100KOHM 1/10W	1	1
RD73FB2A822		CHIP RES.	8.2KOHM 1/10W	2	2
RD73FB2A334		CHIP RES.	330KOHM 1/10W	1	1
RD73FB2A103J		CHIP RES.	10K OHM 1/10W	4	4
RD73FB2A101J		CHIP RES.	100 OHM 1/10W	1	1

## PARTS LIST

PART. NO	NOTE	NAME & DESCRIPTION	DISTINCTION & QUANTITY		REFERENCE NO
			011	061	
RD73FB2A222J		CHIP RES- CHIP RES- CHIP RES-	22K OHM 1/10W 220 OHM 1/10W 33K OHM 1/10W	6 2 2	R R R
RD73FB2A333J					25, 32 21, 28
R12-3449-05	N	TRIM. POT. RESISTOR BLOCK JUMPER WIRE	10K 27K OHM X4 5	1 1 1	VR RB JP
R90-0526-05	N				1, 1 1, 2, 8
R92-1061-05					
R92-1061-05		JUMPER WIRE	5		
S31-1414-05	N	SLIDE SWITCH SLIDE SWITCH	HIL - LD OFFSET	1 1	\$ \$
S31-2409-05	N				1 2
TA7331F	N	IC		1 1	Q Q
1N60A		DIODDE		2 2	D D
2SA1037K(Q)	N	CHIP TR. CHIP TR.		1 1	Q Q
2SA1162(Y)		TR.		1 1	7 7
2SB698(E,F)					3 3
2SC2412K(Q)	N	CHIP TR. CHIP TR.		3 3	Q Q
2SC2712(Y)	N				4, 5 4, 5 8 8

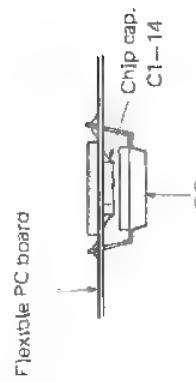
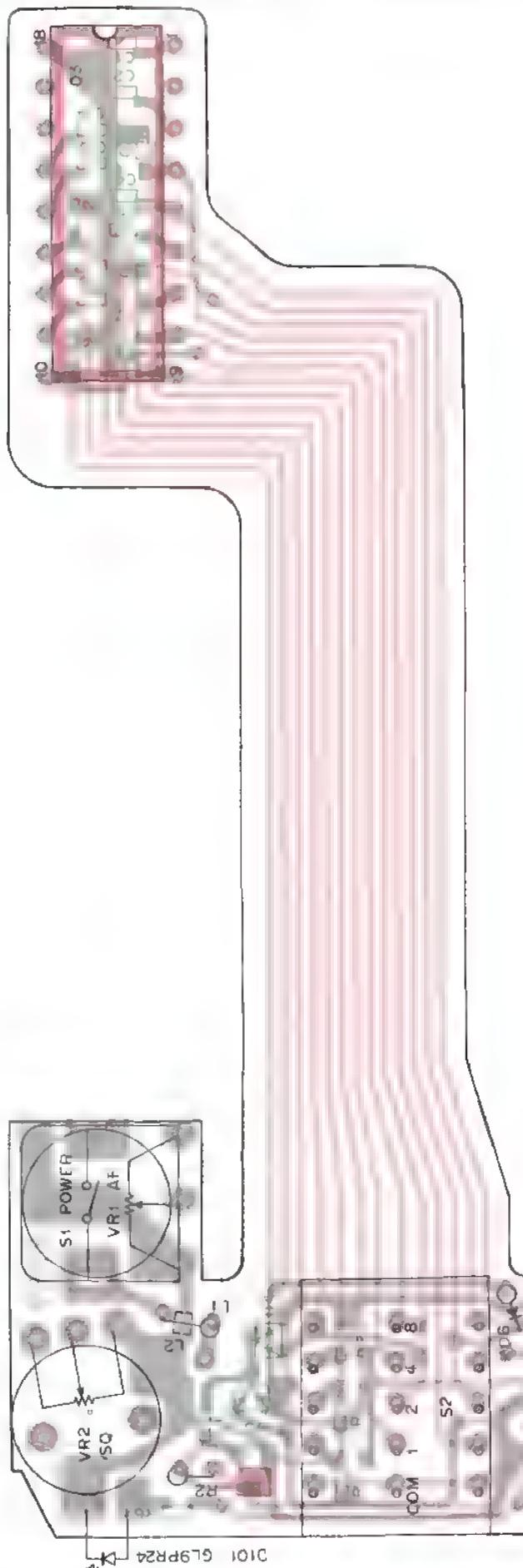
TONE UNIT (X41-1270-XX) {-51 : T :60 : W)

PART-NO.	NOTE	NAME & DESCRIPTION	DISTINCTION & QUANTITY		REFERENCE-NO
			051	060	
CE04CW1C100M		ELECTRO	10	16V	1
CK73FB1H392K		CHIP CAP-	3900P	25V	1
CK73FB1E103K		CHIP CAP-	0.01	25V	3
CK73EB1E333K		CHIP CAP-	0.033	25V	1
NJMS55M	N	IC		1	1
RD73FB2A472J		CHIP RES-	4.7KOHM	1/10W	1
RD73FB2A123J		CHIP RES-	12K OHM	1/10W	2
RD73FB2A333J		CHIP RES-	33K OHM	1/10W	1
RD73FB2A473J		CHIP RES-	47K OHM	1/10W	1
RD73FB2A913J		CHIP RES-	91K OHM	1/10W	1
R12-3452-05	N	TRIM.POT	20K		1
R92-0670-05		CHIP RES-	0 OHM	1	1

## TH-21A/AT/E PC BOARD VIEW

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**SWITCH UNIT (X41-1590-XX) (-11 : K1,K2,M1,M3  
-51 : T -61 : W -71 : M2,M4,X) Component side view**

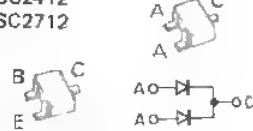


Elective Periodicity

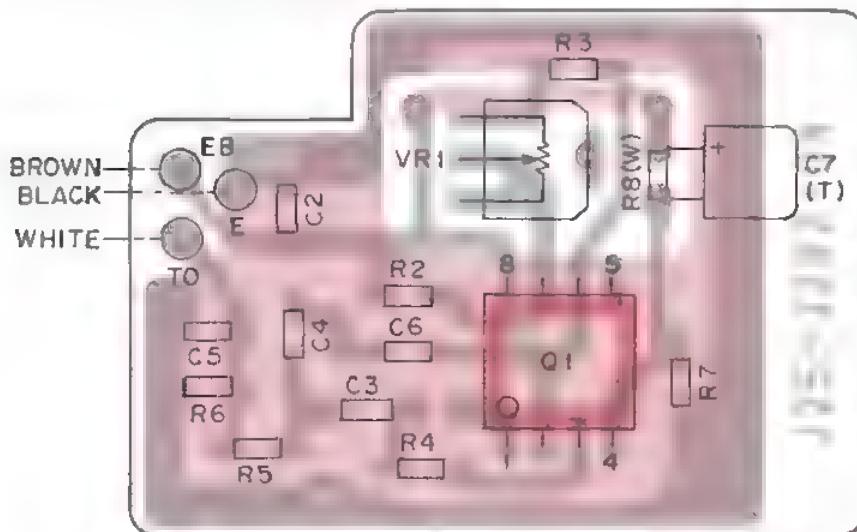
	Q2	D6,9	R3,4,10	JF4	JP5
K1,K2,M1,M3	x	x	x	x	x
M2,M4,X	o	x	o	o	o
T,W	o	o	o	o	x

Q1 2SC2412(K) or 2SC2712(Y) Q2 (M2,MA,X,T,W) 2SC2412(K) or 2SC2712(Y) Q3 TC9122P

2SA1037 MA152WK  
2SA1162  
2SC2412  
2SC2712

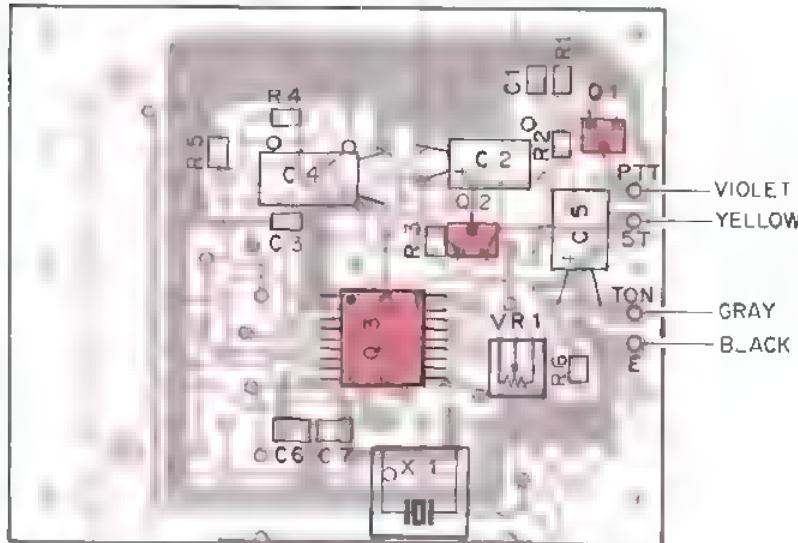


TONE UNIT (X52-1270-XX) (-51 : T -60 : W) Foil side view



Q1 NJM555M

DTMF UNIT (TH-21AT ONLY) Foil side view



Q1 . 2SC2412K(Q) or 2SC2712(Y)

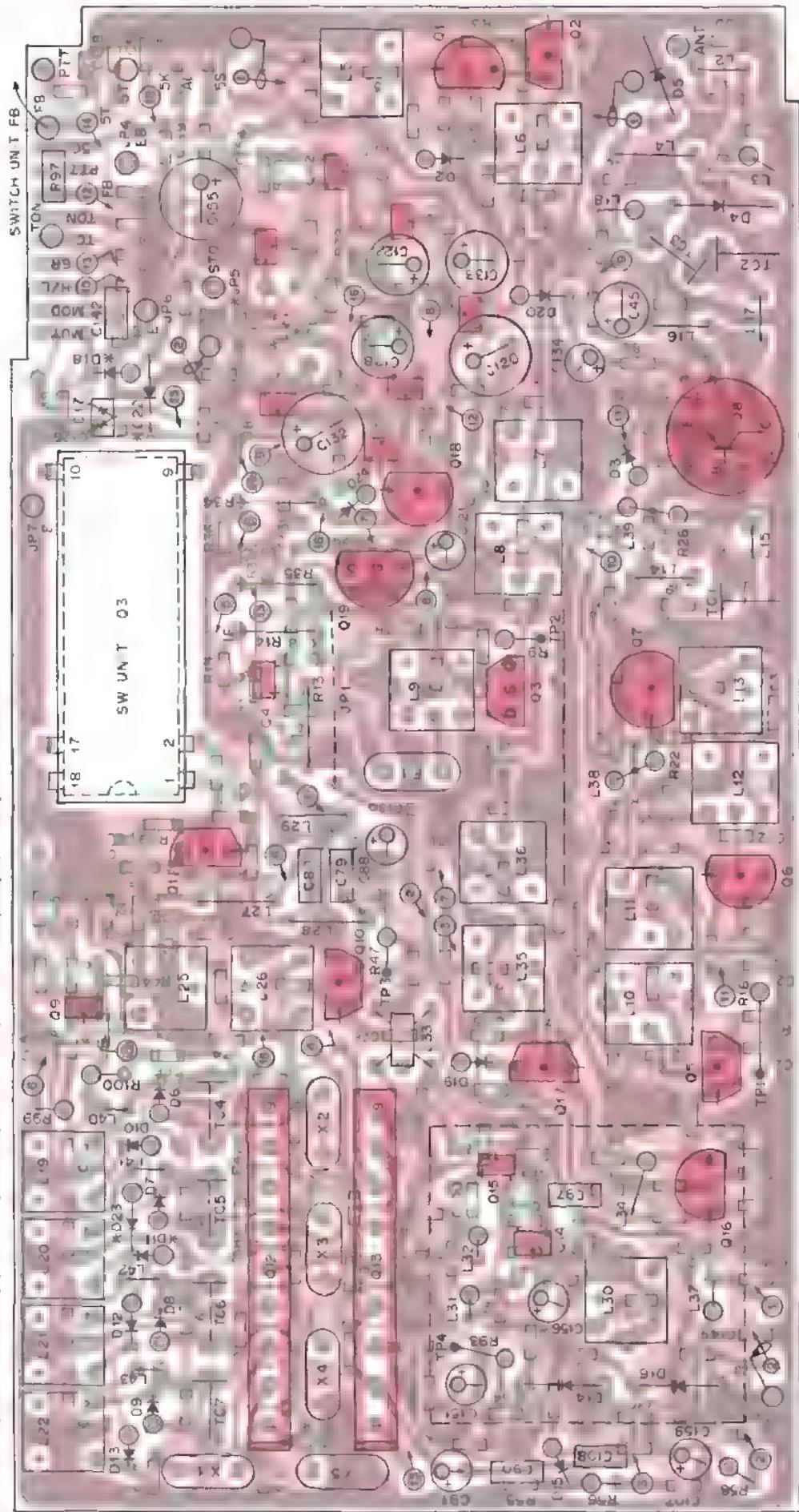
Q2 2SA1037K(Q) or 2SA1162(Y)

Q3 LR40872

CASE (TOP) ASS'Y (A09-0402-05) WITH DTMF

Parts No.	Re. Item No.	Description	Q'ty	Ref. No.
A09-0672-01	N*	Case (Top) 146MHz, KENWOOD		
B42-2344-08	N*	Key board plate		
CC73CH1H300J		Chip cap. 30P 50V	2	C6 7
CE04CW0J100M		Electro 10 6.3V	2	C2,4
CE04CE1C4R7M		Electro 4.7 16V	1	C5
CK73FB1E103K		Chip cap. 0.01 25V	2	C1,3
LR40872	N	I <sup>C</sup>	1	Q3
L7B-0010 05	N	Crystal 3.58MHz	1	X1
RD73FB2A473J		Chip res. 47kΩ 1/10W	5	R1 5
RD73FB2A154J		Chip res. 150kΩ 1/10W	1	R6
R12-3449-05		Trim. pot. 10kΩ	1	VR1
2SA1037K(Q) or		Chip TR.	1	Q2
2SA1162(Y)				
2SC2412K(Q) or		Chip TR.	1	Q1
2SC2712(Y)				

RF UNIT (X44-1630-X) (-11 : K1, K2, M1, M3 -61 : T, W -71 : M2, M4, X) Component side view



Q1.16	25C2271(H)	Q2.5.19.11.17	25C2668(B)	Q3.25K192A(Y)	Q4.8.14.15.25C2714(Y)	Q5.25C2347	Q7.25C2953	Q8.25C1947	Q12.TC5982P
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Q13	TC56981AP	Q18	2SB69981(E)	Q19	2SA1037K(O) or 2SA1162(Y)	Q20	2SA1037K(O) or 2SA1162(Y)	Q21	2SC2412K(O) or 2SC2712(Y)
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G22,24 2SA1037(R) or 2SA1162(G)  
D2,19,20 1SS133 D3,24 1S155b D4 MI,301 D5 1S2588 D6 MI,301 D5 1S2588 D6-9,15 MAS56 D10,12,13 BA282 D11,K1,K2,M1,M2,M3,M4,X1 BA282 D14 ITT310TE

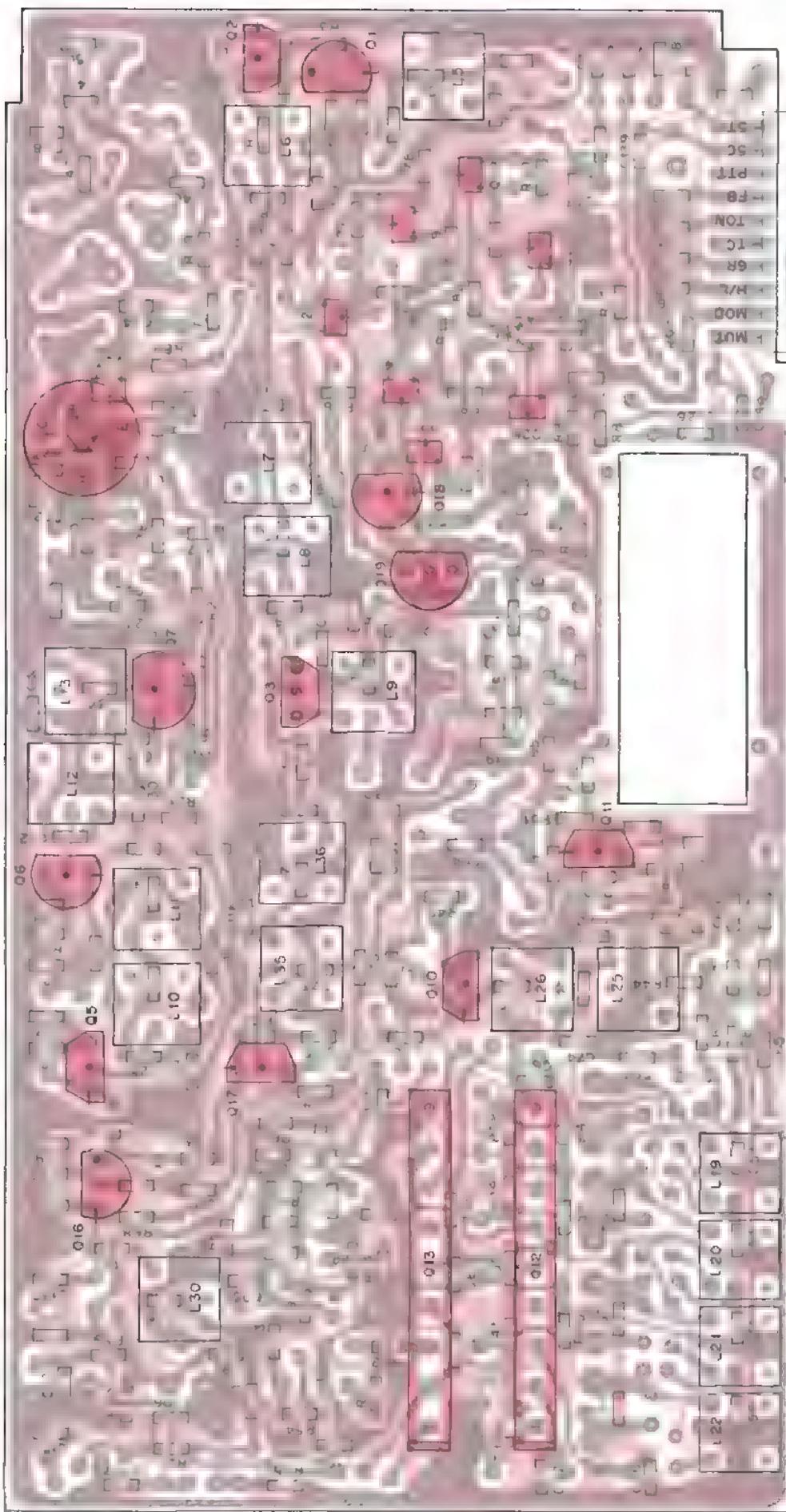
B16 52208 B11.21 WA 152WA B1822 M2, M4, X, T, W, J 351/33 B23 11, W, J BA282

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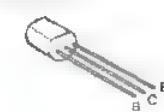
2.3

	D11	D18	22	D23	JP5	C62
K1, K2, M1, M3	O	X		O	O	O
M2, M4, X	O	C	X	O	O	O
7, W	X	O		O	X	X

○ Used, > Not used

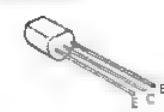


2SC2053

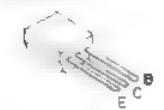


2SB698

2SC2347



2SC2668



2SC2671



2SC1947



LVC517



2SK192A



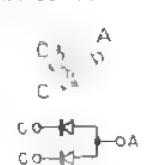
TC5081AP  
TC5082P



2SA1037K  
2SA1162  
2SC2412K  
2SC2712  
2SC2714



MA152WA



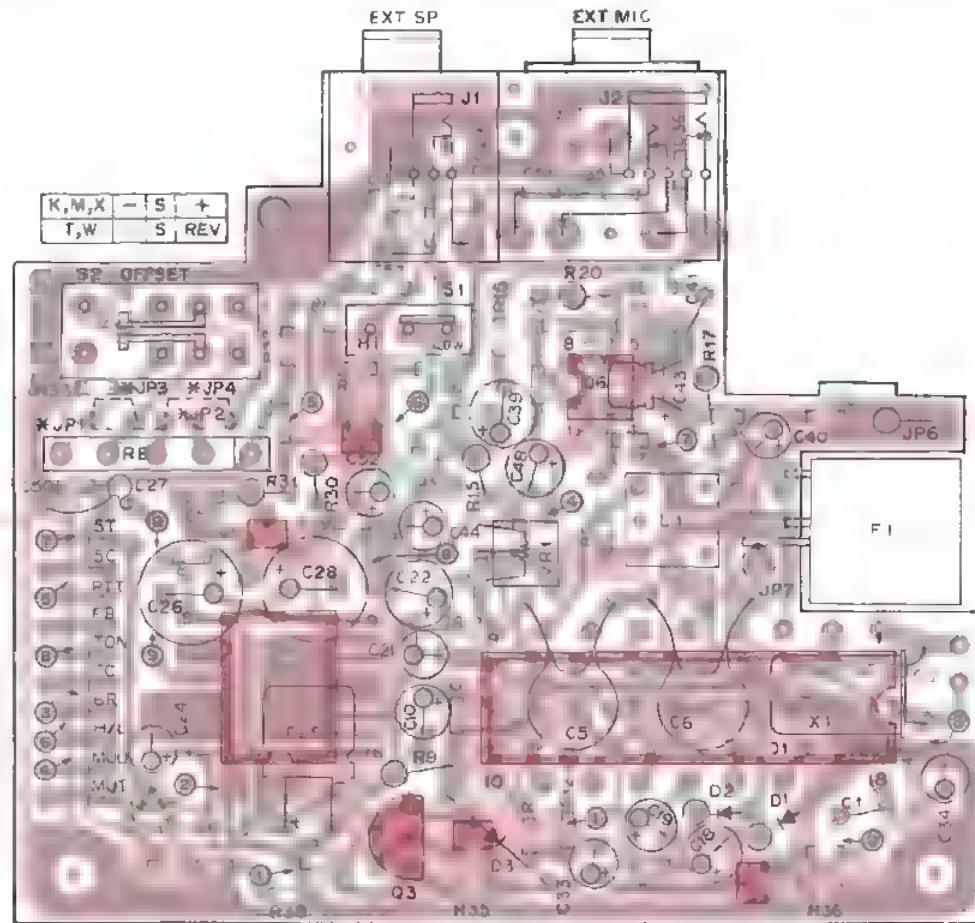
# TH-21A/AT/E PC BOARD VIEWS

IF UNIT (X48-1410-XX) (-11 : K1,K2,M1,M2,M3,M4,X -61 : T,W) Component side view

Q1 MC3359P  
 Q2 TA7331F  
 Q3 2SB698(E,F)  
 Q4,5,8 2SC2412k(Q) or  
 2SC2712(Y)  
 Q6 NJM4558M  
 Q7 2SA1037K(Q) or  
 2SA1162(Y)  
 D1,2 1N80A  
 D3 MT28-8JB  
 D4 MA152WA

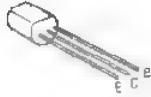
	JP1,2	JP3,4
K,M,X	O	X
T,W	X	O

O : Used, X : Not used



IF UNIT (X48-1410-XX) (-11 : K1,K2,M1,M2,M3,M4,X -61 : T,W) Foil side view

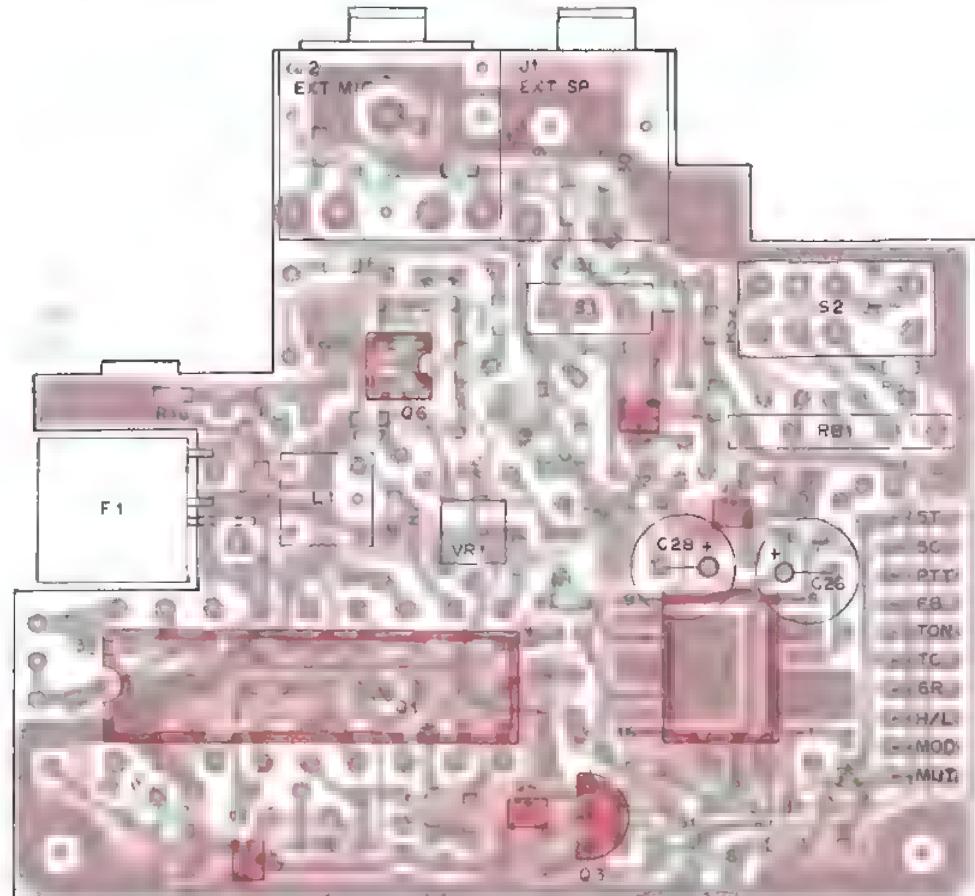
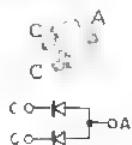
2SB698



2SA1037K  
2SA1162  
2SC2412K  
2SC2712



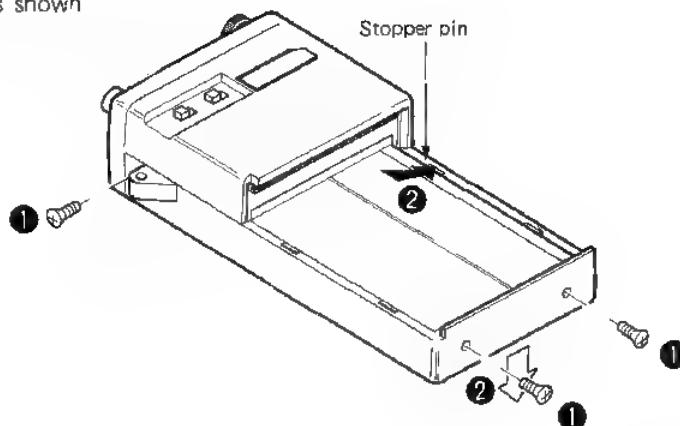
MA152WA



## DISASSEMBLY

### TOP CASE REMOVE METHOD

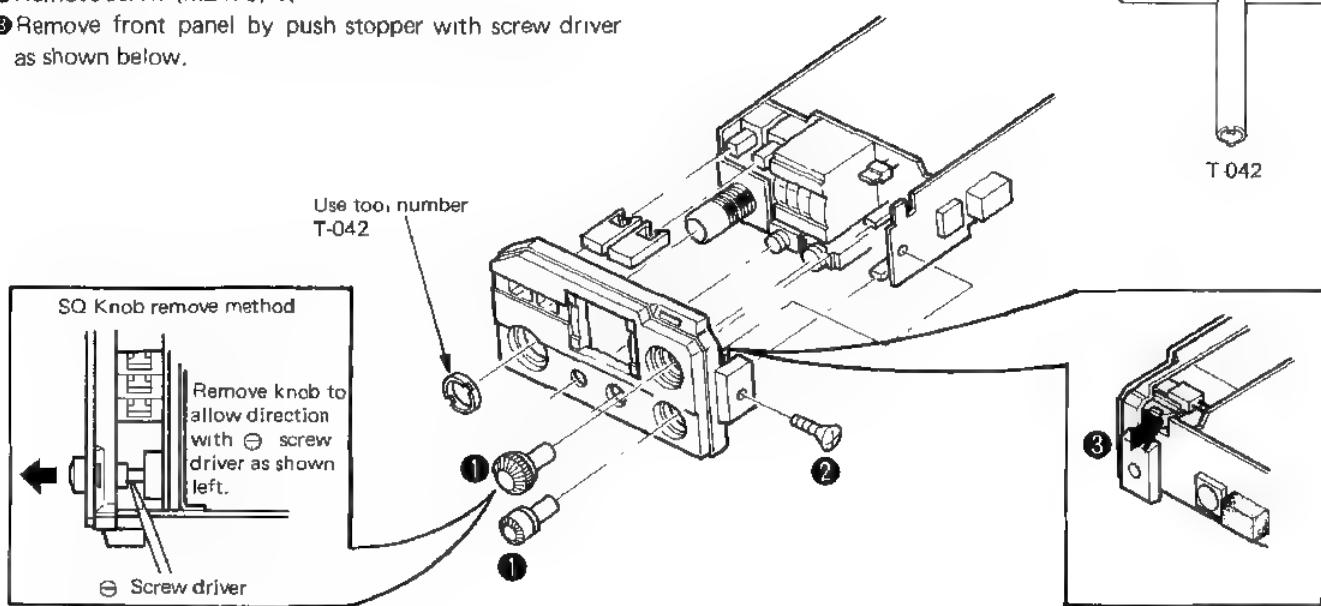
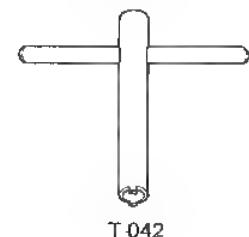
- ① Remove screw (M2 x 5) 3
- ② Remove front case as allow mark direction holding the stop pin with something  $\ominus$  screw driver as shown right.



### FRONT PANEL REMOVE METHOD

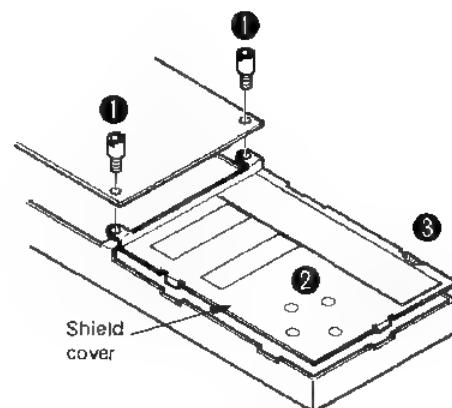
- ① Remove screw on RCA connector and AF, SQ knob.
- ② Remove screw (M2 x 8) 1.
- ③ Remove front panel by push stopper with screw driver as shown below.

### TOOL



### SHIELD COVER REMOVE METHOD

- ① Remove the top boss which tightened the IF unit.
- ② Remove solder at four spots with solder wick.
- ③ Remove solder heating spot with soldering iron.



# TH-21A/AT/E DISASSEMBLY

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FCC plate  
(B42-2343-04) **K1,M1,M2**  
(B42-2359-04) **K2,M3,M4**

Bind screw x 2  
(N35 2005-45)

Special screw x 2  
(N09-D683-05)

Case (bottom)  
(A02-0675-02)

Terminal (inside) x 2  
(E23-0458-04)

Terminal for junction x 2  
(E23-0432-04)

Cushion for junction x 2  
(G13-0802-04)

IF unit  
(X48-1410-11) **K1,K2,M1,M2,M3,M4,X**  
(X48-1410-61) **T,W**

Switch mask (B)  
(F19-0638-04)

Plate  
(B42-2366-04) **K1,K2,M1,M2,M3,M4,T,X**  
(B42-2379-04) **W**

**A** Slide switch HI/LOW  
(S31 1414-05)

**B** Slide switch OFFSET  
(S31-2409-05)

**C** Pan head screw  
(N30-2004-41)

**D** Push knob (B) 5K  
(K27-0469-04)

**E** Push knob (A) TONE  
(K27-3012-04)

**F** Switch unit  
(X41-1590-11) **K1,K2,M1,M3**  
(X41-1590-51) **T**  
(X41-1590-61) **W**  
(X41-1590-71) **M2,M4,X**

Switch mask (A)  
(F19-0637-04)

Mic jack EXT MIC  
(E11-0420-05)

Phone jack EXT,SP  
(E11-0421-05)

Cushion (B)  
(G13-0803-04)

Flexible PC board  
(J25-3251-05)

Ornamental panel  
(A21-0768-02)

Round flat screw  
(N33-2008-45)

Knob (A) AF  
(K29-3012-04)

Knob (B) SQL  
(K29-3013-04)

O ring x 2  
(J69-0309-05)

Electric condenser microphone  
(T91-0312-15)

PTT lever  
(K29-3014-04)

Mic spacer  
(J39-0409-14)

Round boss x 2  
(J32-0785-04)

Shielding plate  
(F10-1314-04)

Serial No. label  
(B42-1745-04)

RF unit  
(X44-1630-11) **K1,K2,M1,M3**  
(X44-1630-61) **T,W**  
(X44-1630-71) **M2,M4,X**

Shielding cover  
(F11-0885-04)

RCA receptacle ANT  
(E13-0165-05)

Tone unit  
(X52-1270-51) **T**  
(X52-1270-60) **W**

Model name plate  
(B40-3510-04) **K1,M1,M2,X**  
(B40-3534-04) **K2,M3,M4**  
(B40-3535-04) **T,W**

Case (top)  
(A02-067D-02) **K1,M1,M2,W,X**  
(A02-0671-02) **T**  
(A02-0672-01) **K2,M3,M4**

Badge  
(B43-1025-04) **K1,M1,M2,X**  
(B43-1029-04) **K2,M3,M4**  
(B43-1032-04) **T,W**

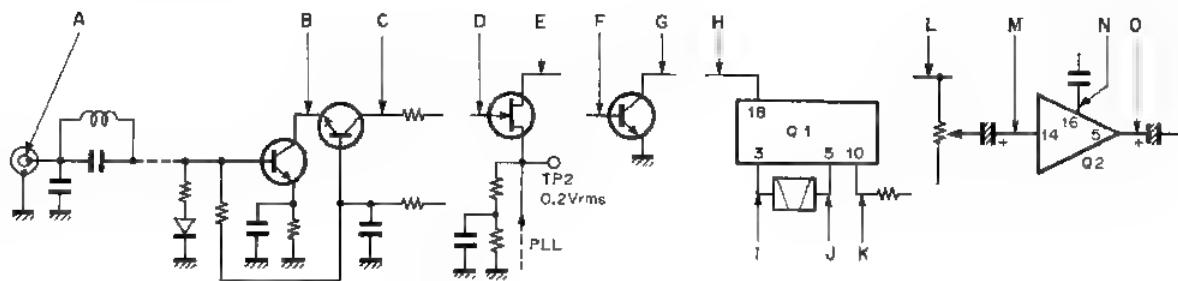
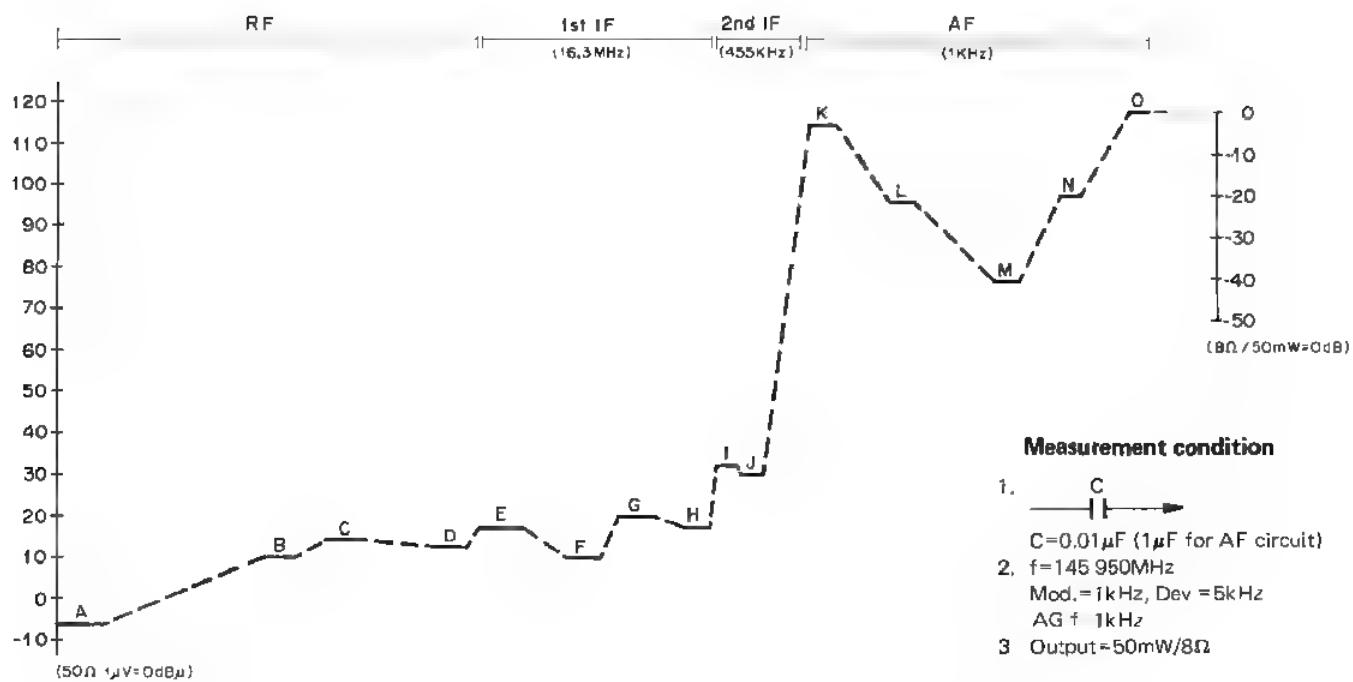
Round flat screw x 3  
(N33-2005-45)

SP metal  
(B04-0408-04) **K1,M1,M2,T,W,X**  
(B04-0409-04) **K2,M3,M4**

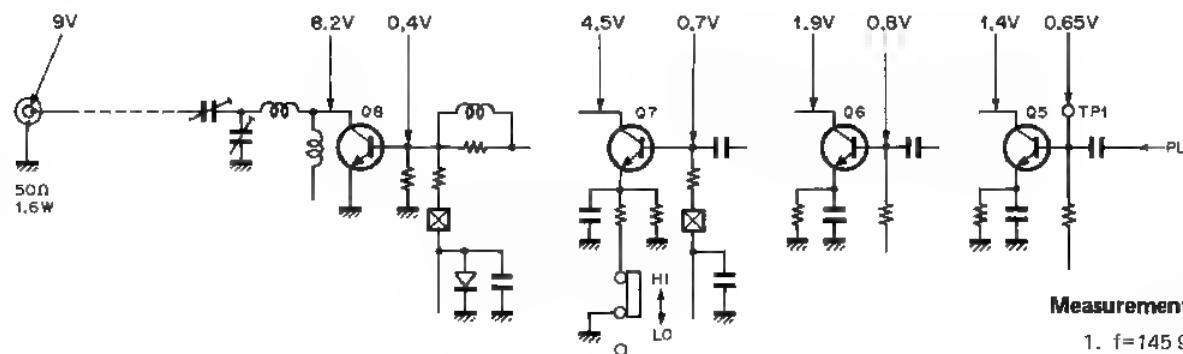
SP grill cloth  
(B05-0733-04)

## LEVEL DIAGRAM

### RX SECTION



### TX SECTION



### Measurement condition

1.  $f = 145.950\text{MHz}$
2. Output = 1.6W

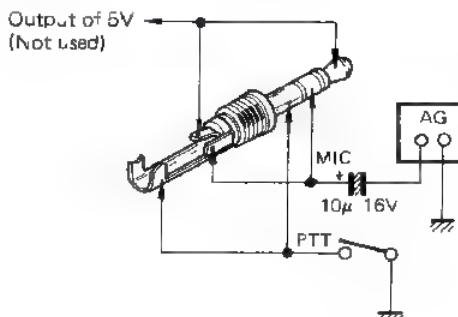
## ADJUSTMENT

## PREOPERATION

Unless otherwise specified, Set the controls as follows.

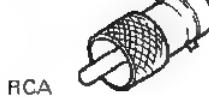
POWER/VOL ..... OFF  
HI/LOW ..... HI  
SQL ..... MIN

- When adjusting the trimmers or coils, use a non-induced adjusting rod of bakelite, etc.
- When adjusting the RX section never transmit to prevent SSG damage.
- Connect MIC connector as shown right.
- Use following RCA-BNC adaptor plug (MODEL AJ-3) for ANT connection.
- The output level of SSG is indicated as SSG's open circuit



MODEL AJ 3

BNC-J



RCA

## TX/RX Section (Common)

Item	Condition	Measurement			Adjustment			Specification/ Remarks
		Test- equipment	Unit	Ter- minal	Unit	Part	Method	
1. Voltage check	1) DC power supply . 7.2V	DC V.M	RF	FB				7.2V
	2) 5C			5C				5.0V
	3) 6R			6R				5.7V
	4) 5T PTT ON			5T				4.9V
	5) Receiver							

## PLL Section

Item	Condition	Measurement			Adjustment			Specifications/ Remarks
		Test- equipment	Unit	Ter- minal	Unit	Part	Method	
1. HET	1) f. any • Cut wire No.1 or connect to GND at Q15 collector on RF unit. • Turn L26 slug all the way inside.  L26 OFFSET switch . "S"	RF VTVM	RF	TP3	RF	L25, 26	MAX Repeat couple times.	Approx. 7mVrms
	2) Connect D17 (or D22) cathode to GND via 100Ω resistor as shown right. Repeat each on TX/RX							
2. PLL voltage setting	1) f = 141.00MHz	DC VM	RF	TP4	RF	L30	0.9V Confirm	0.9V±0.1V 1.6V±0.2V
	2) f = 144.00MHz, Transmt							
	3) Receive							
3. RX. f adjustment	1) f = 145.00MHz (T,W) f = 146.00MHz (K,M,X) OFF SET switch . "S"	f.counter	RF	TP2	RF	L19	128.700MHz (T,W) 129.700MHz (K,M,X) (f-16.3MHz)	Within ±100Hz
	2) 5kHz switch ON							
	3) REV (T,W) only f = 145.00MHz OFF SET switch REV							
	5kHz Switch OFF							
	4) 5kHz switch ON							
					RF	TC4	128.705MHz (T,W) 129.705MHz (K,M,X)	
					RF	L20	128.100MHz	
					RF	TC5	128.105MHz	

## ADJUSTMENT

### TX Section

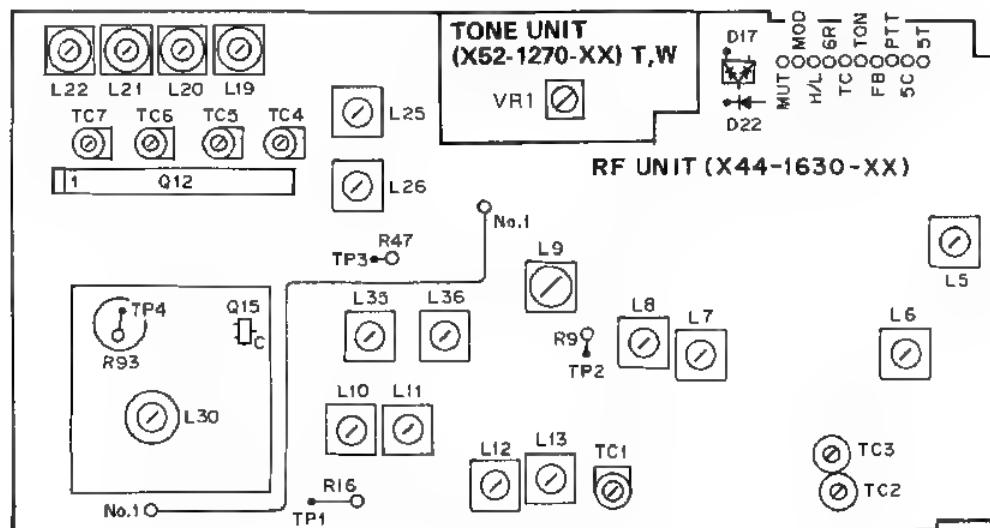
Item	Condition	Measurement			Adjustment			Specifications/ Remarks
		Test- equipment	Unit	Ter- minal	Unit	Part	Method	
1. Power output adjustment	1) f = 145.00MHz (T,W) f = 146.00MHz (K,M,X) ANT : Connect a power meter HI/LO : HI Transmit Power supply : 7.2V	DC AM			RF	L10-13 TC1	MAX	
		Power meter DC AM (1A)		ANT	RF	TC1-3	MAX	1.2W or more 600mA or less
	2) f = 144.00MHz HI/LO : HI HI/LO : LO	Power meter					Confirm	1.0W or more 600mA or less
							Confirm	0.1-0.2W Approx. 300mA
	3) f = 145.96MHz (T,W) f = 147.96MHz (K,M,X) HI/LO : HI HI/LO : LO	Power meter					Confirm	1.0W or more 600mA or less
							Confirm	0.1-0.2W Approx. 300mA
2. Deviation adjustment	1) ANT : Power meter and linear detector, use capacitor 10μF/16V between AG output to MIC terminal f = 145.00MHz (T,W) f = 146.00MHz (K,M,X) AG : 1kHz, 50mV Transmit 2) AG 1kHz, 5mV	Power meter Linear detector		IF	VR1	4.5kHz		4.5kHz±0.1kHz
3. Tone encoder (K2,M3,M4) Type only	1) Push the "3" and "6" key. 2) Push the "2" and "3" key.	Linear detector f. counter		DTMF	VR1	3.0kHz		Within ±0.5kHz
			DTMF	TON			Confirm. freq.	1471.9Hz±5Hz
							Confirm. DEV	1.2kHz±0.5kHz
4. Tone (T,W) type only	1) (T) type only : Shorted C7 (Tone unit) Transmit Tone switch : ON		TONE	TON	TONE	VR1	1750Hz	Within ±17.5Hz
							Confirm. DEV	2.5kHz or more
5. Option tone unit (TU-6) used (K,M,X)	1) Transmit Tone switch : ON			(TU-6)	VR1	0.5kHz		0.5-0.6kHz
6 TX f adjustment	1) f = 145.00MHz (T,W) f = 146.00MHz (K,M,X) OFF SET switch : "S" Transmit 2) 5kHz switch : ON	Power meter f. counter			RF	L21	145.00MHz (T,W) 146.00MHz (K,M,X)	Within ±100Hz
						TC6	145.005MHz (T,W) 146.005MHz (K,M,X)	
						L22	144.400MHz (T,W) 145.400MHz (K,M,X)	
						TC7	144.405MHz (T,W) 145.405MHz (K,M,X)	
						L20	146.600MHz	
						TC5	146.605MHz	

## ADJUSTMENT

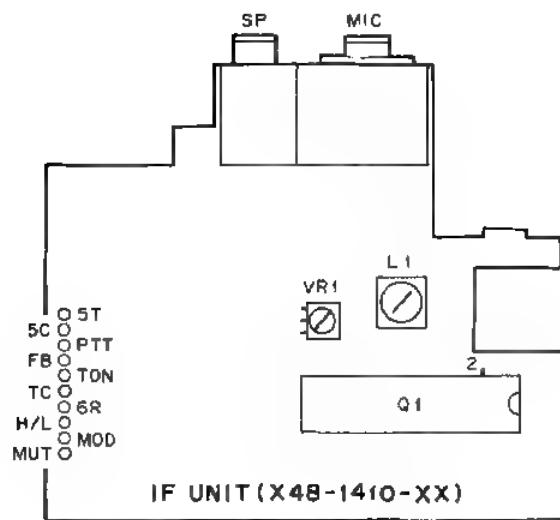
## RX Section

Item	Condition	Measurement			Adjustment			Specifications/ Remarks
		Test- equipment	Unit	Ter- minal	Unit	Part	Method	
1 Sensitivity	1) f : any 2) SSG : 145.04MHz (T,W) 146.04MHz (K,M,X) -4~-6dBμ MOD: 1kHz DEV, 5kHz	f.counter SSG AF V.M Oscillo- scope 8Ω Dummy load	IF EXT SP DUT ANT SP TH 21	Q1- 2 RF L5-8 L9,35, 36 8Ω Dummy Load AF V.M Oscilloscope			Confirm MAX	15.845MHz±240Hz
S/N	3) f = 144.00~147.99MHz (K,M,X) f = 144.00~146.99MHz (T,W)				IF L1		MAX	S/N 28dB or more

### TOP VIEW



### **BOTTOM VIEW**

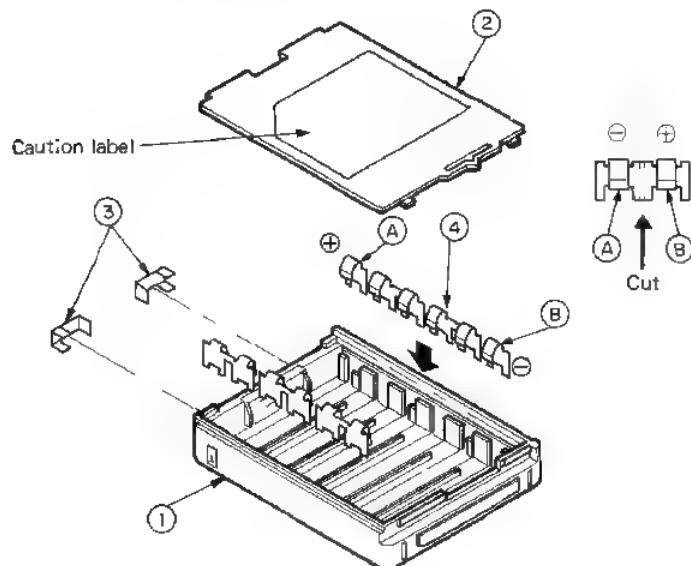


**BT-2 (AAA MANGANESE/ALKALINE BATTERY CASE)/  
EB-2 (EXTERNAL C MANGANESE/ALKALINE BATTERY CASE)/  
PB-21 (Ni-Cd BATTERY)**

**BT-2 OUTSIDE VIEW**



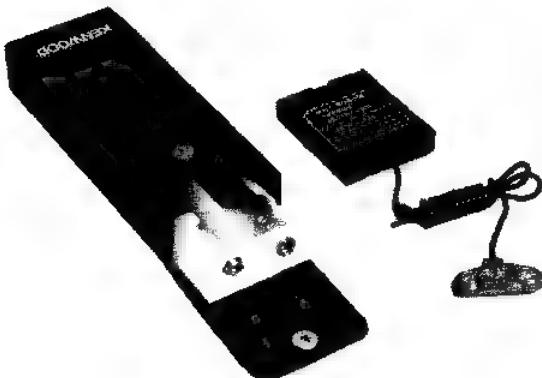
**BT-2 DISASSEMBLY**



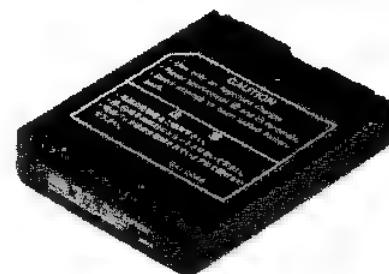
**BT-2 PARTS LIST**

Parts No.	Re- marks	Description	Ref. No.
A02-0677-02	*	Battery case	1
A02-0678-03	*	Battery case cover	2
E23 0451 04		Terminal board (A) x 2	3
E23-0452-04		Terminal board (B) x 6	4

**EB-2 OUTSIDE VIEW**



**PB-21 OUTSIDE VIEW**



**EB-2 PARTS LIST**

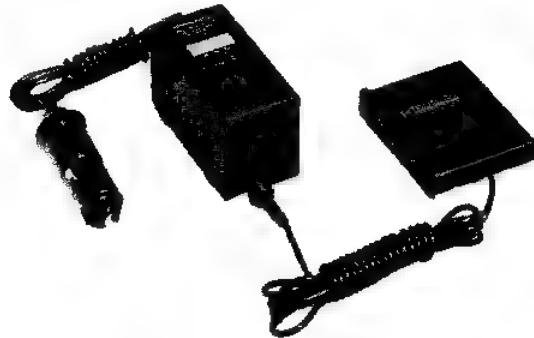
Parts No.	Re- marks	Description	Ref. No.
A02-0677-02	*	Battery case	
A02-0678-03	*	Battery case cover	
E23 0451 04		Terminal board (A) x 2	
E30-1793-05	N*	Cord ass'y	
H25-0103-04		Protective bag (Hard case)	
H25-0096-04		Protective bag (Battery case)	
J21-4154-04	N*	Field plate (Cord bushing)	

**PB-21 SPECIFICATIONS**

Output voltage	7.2V
Charging current	36mA (ordinary charging for approx. 8hrs.)
Charging current	180mA
Dimensions	57 (W) x 71 (H) x 14 (D) mm
Weight	Approx. 80g

## **DC-21 (DC-DC CONVERTER)/SC-8/8T (SOFT CASE)**

## DC-21 OUTSIDE VIEW



## SC-8 OUTSIDE VIEW



## DC-21 SPECIFICATIONS

<b>Input voltage</b>	13.8V DC (12–16V)
<b>Output voltage</b>	8V DC $\pm$ 5%
<b>Output current</b>	900mA (at input voltage of 13.8V DC with max. load)
<b>Weight</b>	Approx. 260g

## DC-21 PARTS LIST

Parts No.	Re- marks	Description	Ref No
A02-0677-02	*	Battery case	
A02-0678-03	*	Battery case cover	
E03-0203-05		DC jack	
E23-0451-04		Terminal board (A) x 2	J1
E30-1791-05		Cord with plug	
E30-1796-05		Cord with cigarette plug and fuse	
F05 2023-05		Fuse 2A	
J42-0439-05		Cord bushing	
L15 0305-05		Choke coil 1mH	L1
NJM7808A		IC	IC1
SLH 34 VC3		LED (Red)	D3
U05B		Diode	D1
V06C		Diode	D2

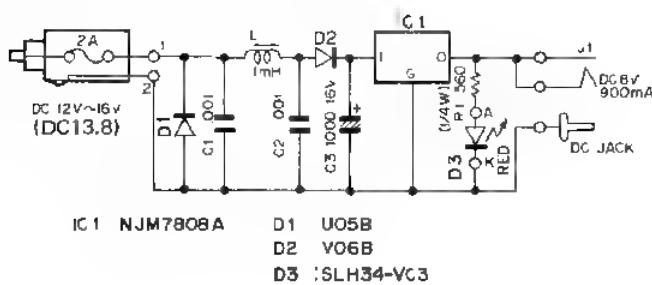
## SC-8T OUTSIDE VIEW



## SC-8/8T PARTS LIST

Parts No.	Re- marks	Description	Ref. No.
J19-1408-04	N	Belt hook	

## DC-21 SCHEMATIC DIAGRAM



## SMC-30 (SPEAKER MICROPHONE)/ TU-6 (PROGRAMMABLE TONE ENCODER) TH-21A/AT ONLY

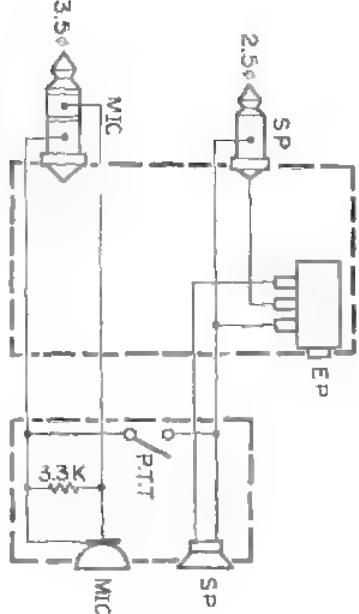
### SMC-30 OUTSIDE VIEW



### SMC-30 PARTS LIST

Parts No	Re. No.	Description	Ref. No
E30-1789 05	N	Cuffed cord ass'y	
J19-1360 08		Clip menu fitting	
J42 0429 08		Cord bushing	
K29-3035-08	N	PTT knob	
T07-0219-08		Speaker	
T97-024-08		Micro switch	
S50-1408-08		Electret microphone	

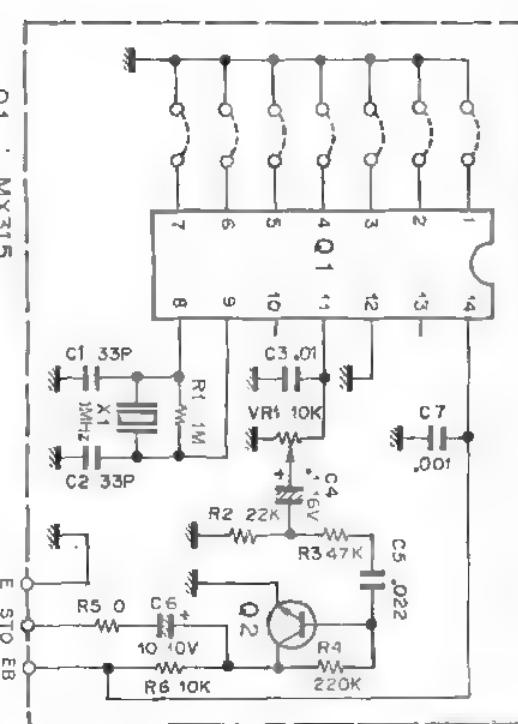
### SMC-30 SCHEMATIC DIAGRAM



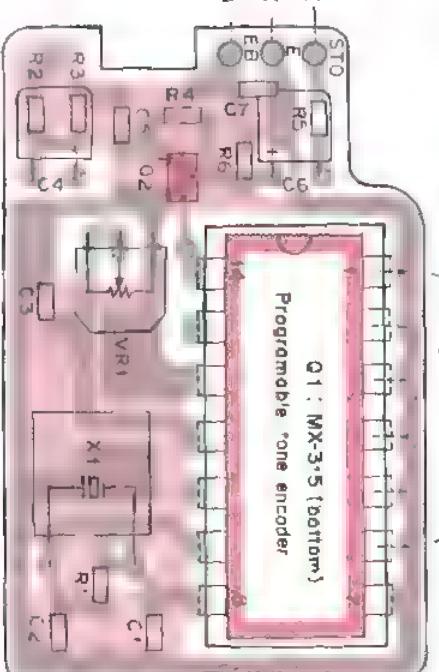
### SMC-30 SPECIFICATIONS

• <b>SPEAKER</b>	
Speaker	40mmφ
Max. Input	0.5W
Input impedance	8Ω
• <b>MICROPHONE</b>	
Type	Electret condensor
Sensitivity	-67dB
Output impedance	2kΩ
Frequency response	200Hz~5kHz
Operating temperature	-20°C~+60°C
Dimensions	51W x 3H x 33D (mm) (Projectors excluded)
Weight	130g (Code included)

### TU-6 SCHEMATIC DIAGRAM (X52-1320-10)



TU-6 PC BOARD VIEW  
TONE UNIT (X52-1320-10) Foil side view



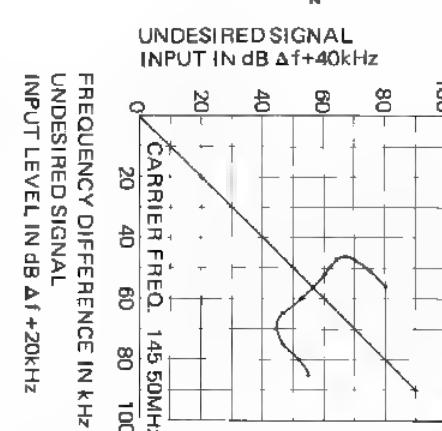
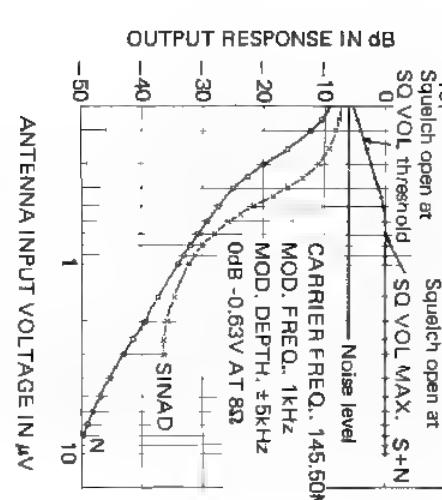
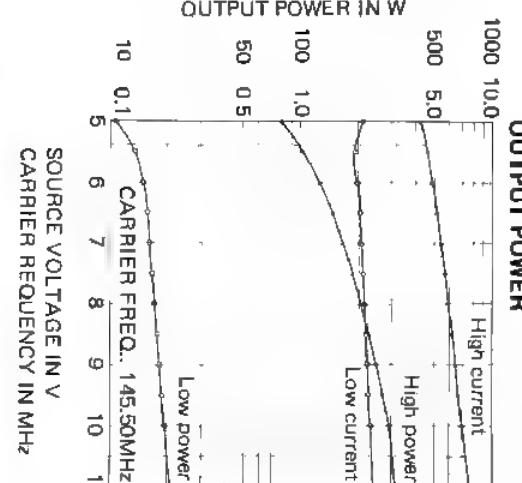
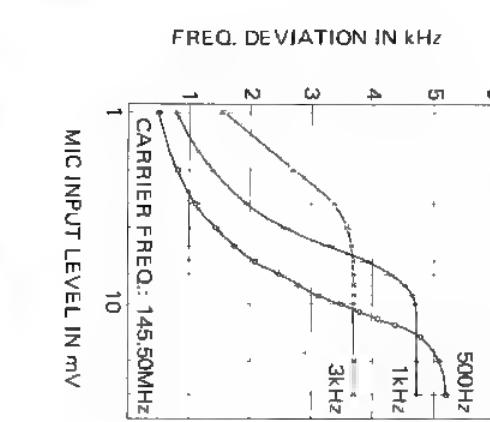
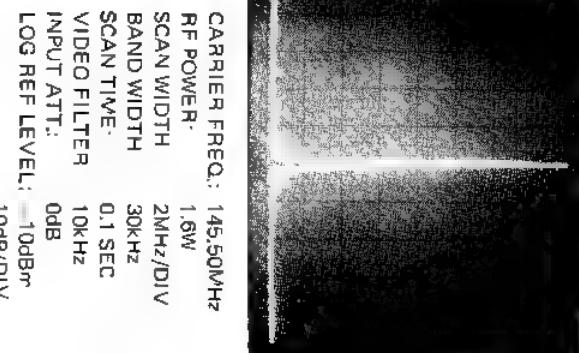
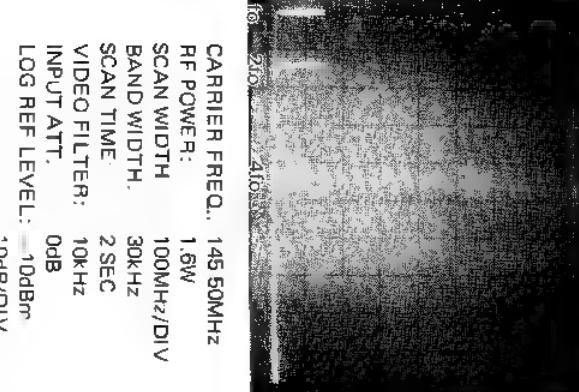
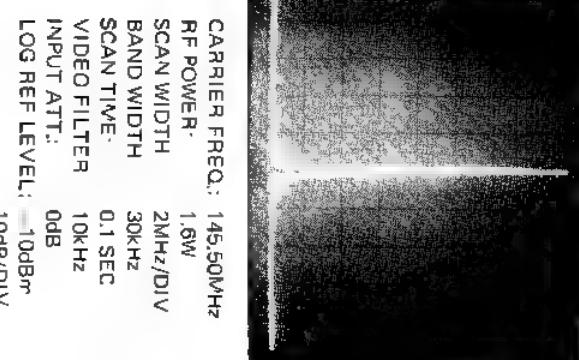
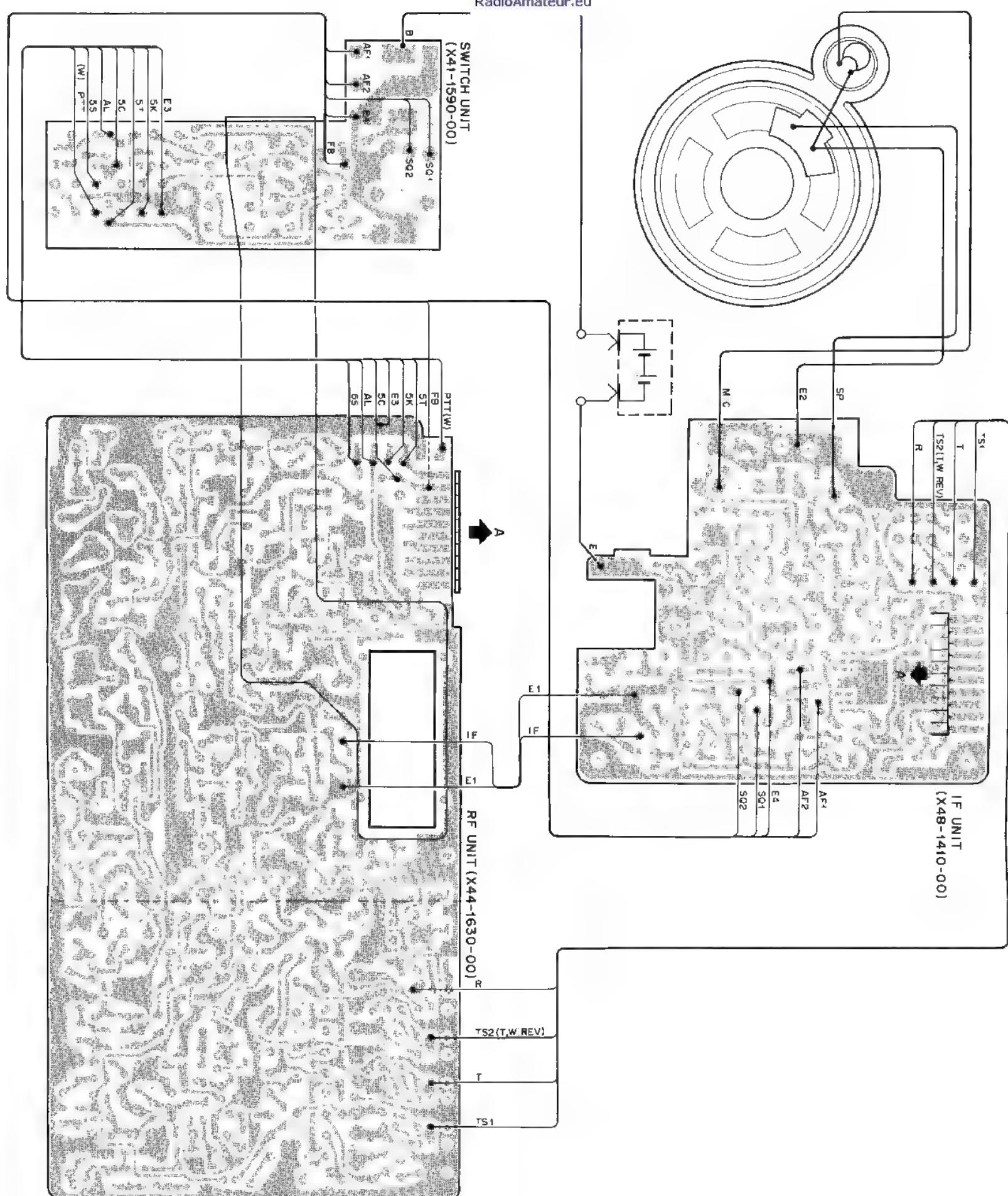
MX-315

TU-6 SPECIFICATIONS		TU-6 FREQUENCY CHART	
Oscillator frequency	1MHz ± 0.1%	Usable frequency range	37.5Hz
Weight	3g	Specification Group Frequencies	(67.0~250.3Hz)
Setting the frequency			
Cut and connect pins 1~6 of the C to the PC board pattern by so dering to set the frequency			
• "0" in the table indicates the connection.			
• "1" in the table indicates the disconnect on.			

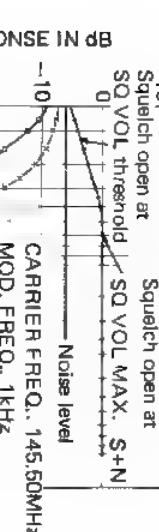
E.A.	Program Lines	E.A.	Program Lines
Group	1 2 3 4 5 6	Group	1 2 3 4 5 6
1	1 1 1 1 1 1	1	1 1 1 1 1 1
2	1 1 1 1 1 1	2	1 1 1 1 1 1
3	1 1 1 1 1 1	3	1 1 1 1 1 1
4	1 1 1 1 1 1	4	1 1 1 1 1 1
5	1 1 1 1 1 1	5	1 1 1 1 1 1
6	1 1 1 1 1 1	6	1 1 1 1 1 1
7	1 1 1 1 1 1	7	1 1 1 1 1 1
8	1 1 1 1 1 1	8	1 1 1 1 1 1
9	1 1 1 1 1 1	9	1 1 1 1 1 1
10	1 1 1 1 1 1	10	1 1 1 1 1 1
11	1 1 1 1 1 1	11	1 1 1 1 1 1
12	1 1 1 1 1 1	12	1 1 1 1 1 1
13	1 1 1 1 1 1	13	1 1 1 1 1 1
14	1 1 1 1 1 1	14	1 1 1 1 1 1
15	1 1 1 1 1 1	15	1 1 1 1 1 1
16	1 1 1 1 1 1	16	1 1 1 1 1 1
17	1 1 1 1 1 1	17	1 1 1 1 1 1
18	1 1 1 1 1 1	18	1 1 1 1 1 1
19	1 1 1 1 1 1	19	1 1 1 1 1 1
20	1 1 1 1 1 1	20	1 1 1 1 1 1

TU-6 PARTS LIST		TU-6 GENERAL	
Parts No	Re. No.	Description	Ref. No
B50-4178-00	N	Instruction manual	1
G13-0806-04	N	Cusion	1
H25-0029-04		Protective bag	1
X52-1320-10	N	Tone unit	1
TONE UNIT (X52-1320-10)			
C90-0888-05		Cerio cap	33P
		C1.2	2
		C6	1
		C7	1
		C4	1
		R3	1
		R6	1
		R1	1
		R2	1
		R4	1
		R5	1
		R7	1
		R8	1
		R9	1
		R10	1
		R11	1
		R12	1
		R13	1
		R14	1
		R15	1
		R16	1
		R17	1
		R18	1
		R19	1
		R20	1
		C3	1
		C5	1
		C6	1
		C7	1
		C8	1
		C9	1
		C10	1
		C11	1
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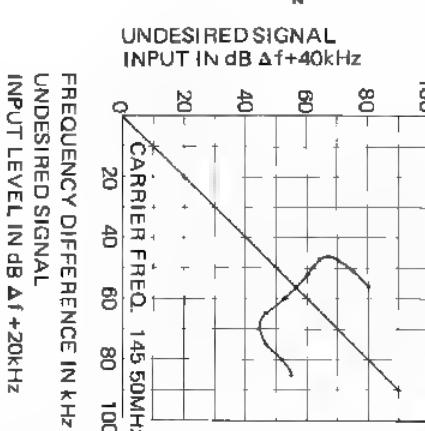
## WIRING/REFERENCE DATA



## RX SENSITIVITY



## INTER MODULATION

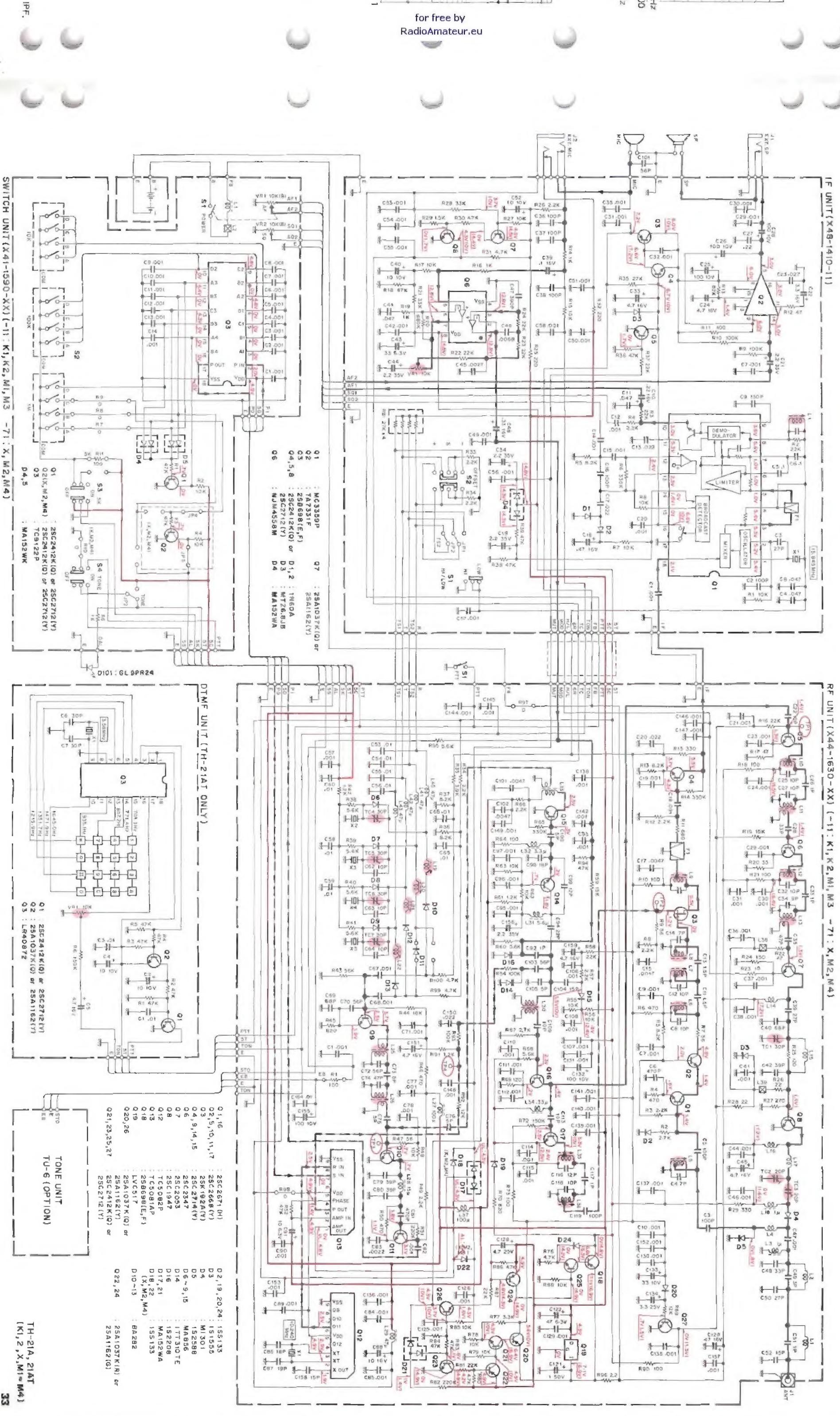


## TH-21A/AT SCHEMATIC DIAGRAM

for free by  
RadioAmateur.eu

Voltage measurement conditions { = 145.50MHz, RX no signal, ( ) : TX,

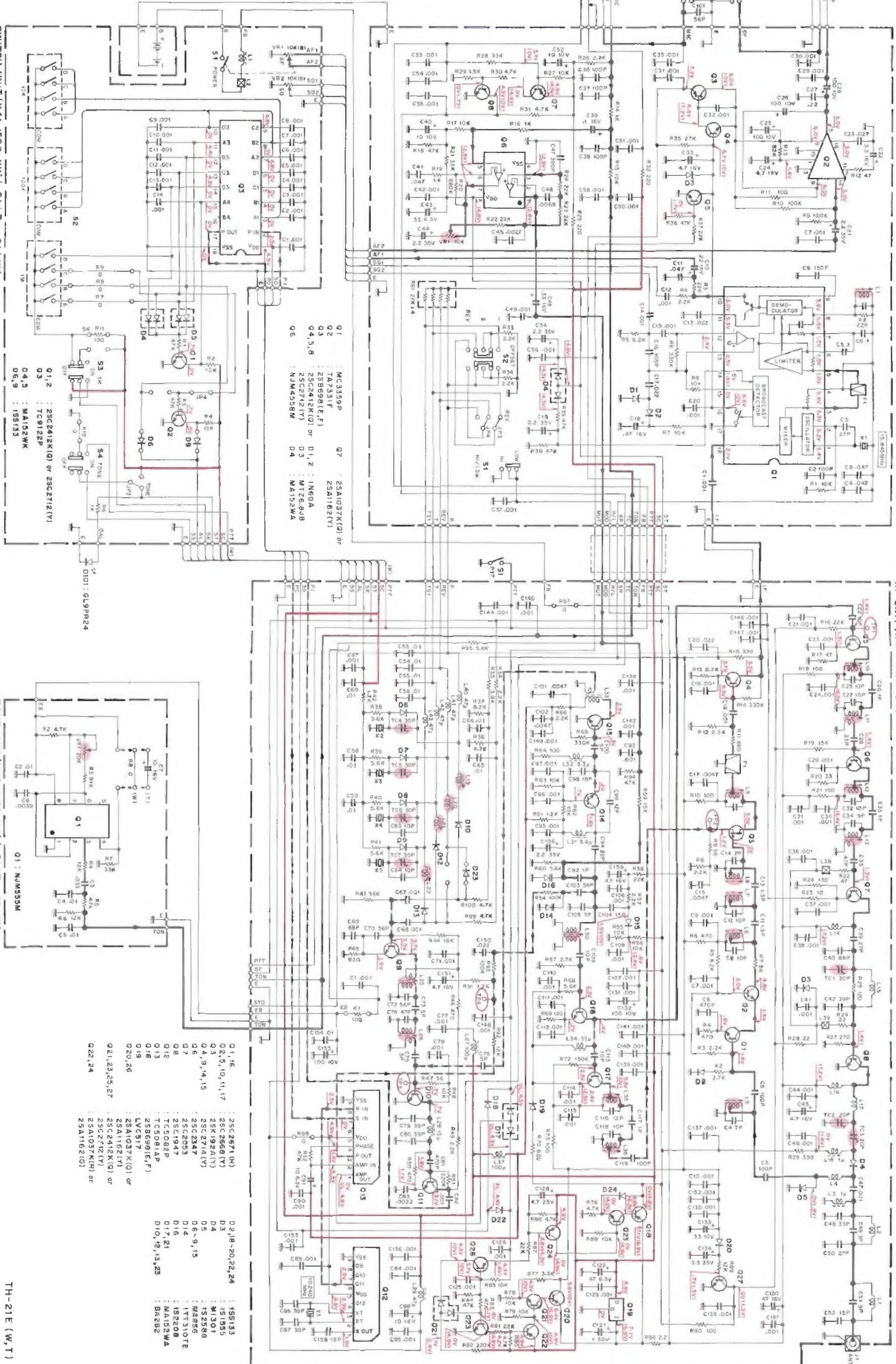
DIAGRAM

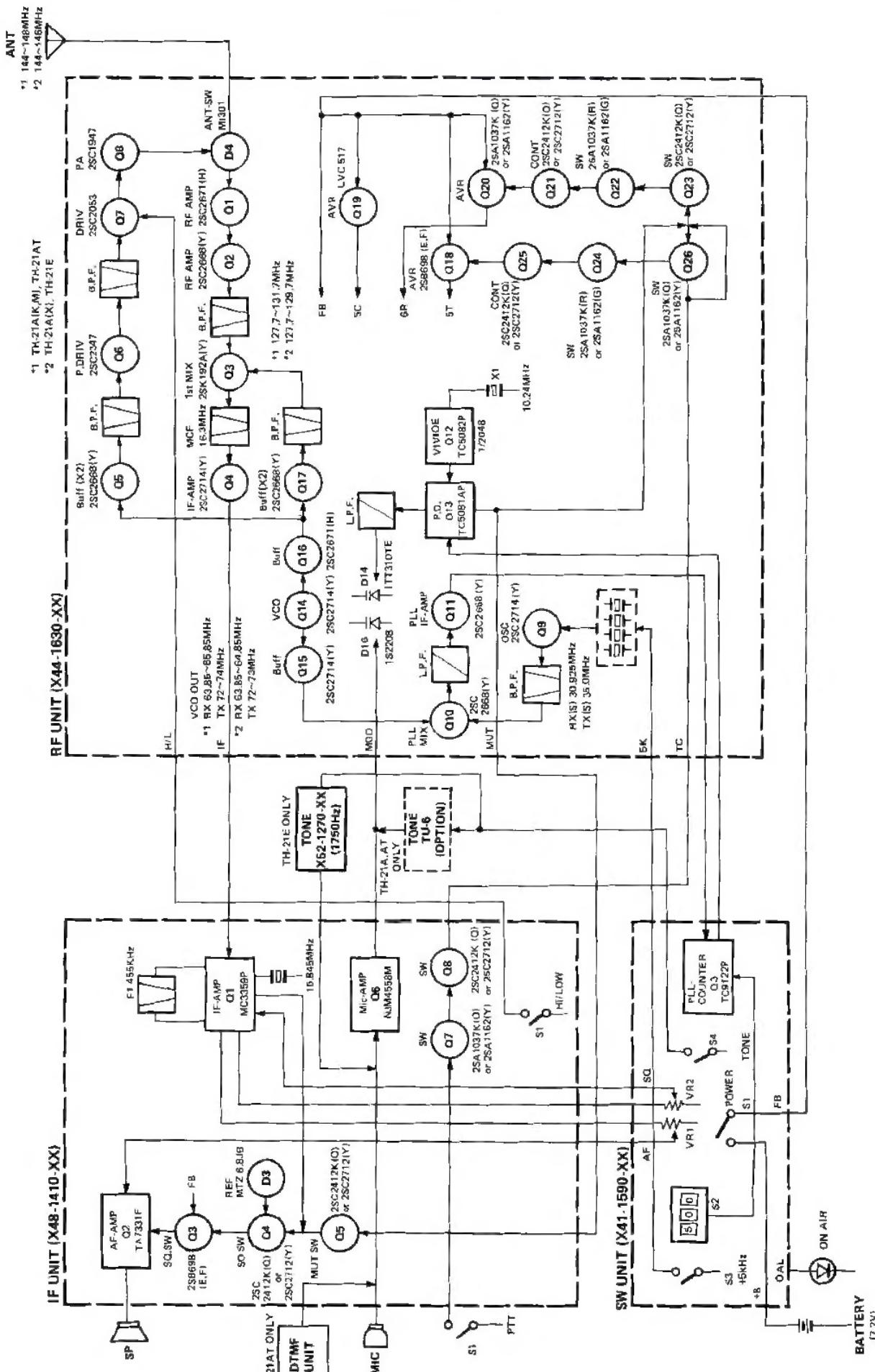


Signal line

Control line

Voltage measurement conditions  $f = 145.500\text{MHz}$ , RX no signal, 1 : TX





**SPECIFICATIONS****General**

Frequency range .....	144 – 146MHz ; TH-21E, TH-21A (Oceania version only)
	144 – 148MHz ; TH-21A/AT
Signal type .....	F3 (FM)
Operating temperature .....	-20°C ~ +50°C
Antenna impedance .....	50Ω
Power supply voltage .....	5.8V – 10.0V (rating voltage ; 7.2V)
Power consumption .....	At reception standby ; Less than 28mA At transmission (Hi) ; Less than 600mA (Low) ; About 300mA
Dimensions .....	57 (65.5) W x 120 (127.5) H x 28 (32) D mm The numbers in the parenthesis include projections parts.
Weight .....	Approx. 290g (including antenna and Ni-Cd batteries)

**Transmitter section**

Output power .....	Hi ; 1.0W, Low ; approx. 150mW
Modulation system .....	Reactance modulation
Max. frequency deviation .....	±5kHz
Unwanted reflection .....	Less than -60dB
Microphone .....	Condenser type

**Receiver section**

Reception system .....	Double superheterodyne
Intermediate frequency .....	1st ; 16.3MHz, 2nd ; 455kHz
Sensitivity .....	S/N more than 28dB at -6dB $\mu$ (0.5 $\mu$ V) input 12dB SINAD ; less than -12dB $\mu$ (0.25 $\mu$ V)
Squelch sensitivity .....	Less than 0.25 $\mu$ V
Selectivity .....	-6dB at more than 12kHz -40 dB at less than 28kHz
AF output .....	More than 250mW (8Ω load, distortion 10%)

Design and specifications subject to change without notice.

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